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THE BALTIMORE ORIOLE AND CARPENTER-BEE.

BY REV. SAMUEL LOCKWOOD, PH. D.

Doubtless the ancients were as honest as the moderns. But were they as painstaking and therefore as trustworthy? Those olden treatises on Nature stood upon a sort of exacting didactic dignity of their own, even when they discoursed of marvels akin to

> "The Anthropophagi and men whose heads
> Do grow beneath their shoulders!"

It has always been easier to imagine than observe. Thus has instinct too long been regarded in the beast as the functional equivalent of reason in man; as if man had no instinct, and the beast no reason.* And how vitiating an element has this proved in our natural theology. How many believe the pseudo-axiom that of necessity every bird builds its nest to-day as did its ancestors six thousand years ago? Is not instinct transmitted, or inherited habit? And so there may be relatively new instincts as well as old ones. The trained animal — the setter, the pointer, the retriever—transmits to its offspring those traits which have become the habit, the resultant of long training. The cow migrates to Norway and, contrary to the bovine instinct, eats the fucus off the sea rocks, and finally becomes an eater of fish. Her offspring take to it naturally, that is, instinctively. The mountain parrot, (*Nestor notabilis*) called by the Maories, Kea, is a simple honey

* Pythagoras taught that animals had reason but no mind.—Eds.

eater. This bird has lately found out that mutton is good; and actually combines in flocks to attack sheep, eating the live flesh from the animal's back and sides.

But what has all this to do with orioles and bumble bees? Let us see.

At the beginning of June, I received a small package from Rev. Dr. Campbell, President of Rutger's College. It contained several carpenter-bees, each with its head detached. All the president could tell me, was that they were picked up under a tree in the college campus; and an explanation was asked of the phenomenon. A good deal puzzled, I ventured a provisional statement, a sort of hypothesis which, at least, had the merit of seeming probable. It was shot at a venture and, like such shots generally, it hit wide of the mark. I had just closed quite a long course of lectures on natural history in the grammar school of that institution, and this question, becoming somewhat general, made me feel like one put on his mettle, so I went at it resolved to work out the case if possible.

In the campus were two beautiful horse-chestnut trees, *Æsculus hippocastaneum*. They were large trees, and resplendent with their dense panicles of bloom; every one, as it stood gorgeously upright, seemed a thyrsus worthy the hand of a god. These trees formed the great attraction of honey-seeking insects. It was only under these trees that the headless bees were found, but there they lay in hundreds; the ground was literally speckled with them. Strange to say, the slain insects consisted of but one species and one sex. They were carpenter-bees, of the species *Xylocopa Carolina*, and all were males. Now these males are stingless, and have a white face. I picked them up by handfuls, all headless, the heads lying on the ground. I searched diligently for a head without that characteristic white face which designates the stingless male, but could not find one. Indeed, I entertain no doubt that, of the large number of these decapitated bees, every one was a stingless male. One fact was now apparent, the massacre was made up among the flowers, while the insects were in quest of honey. But what had done it? How was it done? And for what purpose? On these three questions the whole case rested. If they could be answered, the mystery would be solved.

It appeared under the microscope that the severance of the head from the body was clean and not bunglingly done. The head was

not pulled nor twisted off, but cut or snipped off and always at one place, the articulation. But so far the whole affair seemed the result of sheer wantonness, much as I have seen some vicious children beheading flies. The case had become intensely puzzling; for Nature is neither wanton nor wasteful. It seemed to me that no bird would do it, for what could be the object of such waste? Again, it seemed that no strictly aërial insect could do it. Indeed, for an insect to capture and decapitate this great carpenter bee while on the wing or among the flowers, it would require a rare combination, a powerful apparatus for attack and uncommon facilities of flight.

And now was disclosed another wonder. On opening one of these headless insects the body was found to be hollow. Then a number were opened, and every body was found in like manner to be empty. The fact was now apparent that the bodies of all these headless bees had been emptied after decapitation. They had been literally eviscerated at the annular opening made at the neck by the separation of the head. Not a wound nor a mark could be found anywhere on the body. I now began to suspect that the whole was the work of birds. Inquiry was made of the German janitor who seemed pleased to be able to give a direct answer, to the effect, that ever since the horse-chestnut flowers had come out, three or four very beautiful birds had come every day to the trees and had been killing the carpenter-bees. Under the circumstances this information was very opportune. He was not able to give an intelligible description of the birds; so I asked him to watch and shoot one for me, which he did the next day. It was a Baltimore oriole or golden robin (*Icterus Baltimore*). The specimen was a beautiful male, a last summer's bird, hence hardly a year old. Its plumage was perfect, but the colors not so deep as those of a more mature bird.

The Baltimore oriole is an insect and berry eating bird. But here was a new habit of a curious and interesting character. If the Kea turns from honey to flesh, we find our oriole preferring honey to insect food, and resorting to the most singularly ingenious and outré methods to procure it — and with what intelligence! When a boy, in common with his schoolmates the writer often captured the humble-bee, extracted the honey sac and sucked out its luscious contents. How did those four golden robins find out our boy secret? We should rather have said secrets

—for not only did we boys know where the honey lay, but we prided ourselves on knowing that the white-faced carpenter-bees could not sting. As we have shown, our orioles found out this fact also. In their operations they caught the bee on the flower. This of course was done with the bill. The victim was then transferred to one foot and securely held in the claws, while the head was snipped off; then the sharp, narrow bill and tongue were applied to extract the sac containing the valued sweets. From every point of view this new habit appears to us extraordinary; and if these orioles generally get into the secret, it must needs go hard with the carpenter-bees; at least with the stingless ones or, as Patrick observes, those of the male persuasion. And then when we look at the similarity of the acquired new habits in the two cases mentioned, how remarkable the parallelism of the epicurean instincts of the Australian and the American birds! In both cases is there a singular change of the food propensities, and an equally seeming cruel wantonness in gratifying the same. As the poor victims lay before me, I was drawn to think of the old legal barbarity expressed in the judgment, "to be hung, drawn, and quartered;" for, pitiful sight, in my very hand lay these decapitated and eviscerated objects still manifesting a vestige of life in the automatic movements of the legs of the body and the palpi of the head. May it not be asked, if the birds are learning the secrets, and practising the ways of men, and even like them acquiring more refined tastes, whither will the march of intellect lead? At any rate does there not seem to be some connection of our opening homily with orioles and bumble-bees?

NOTES ON THE VEGETATION OF THE LOWER WABASH VALLEY.

BY ROBERT RIDGWAY.

II. PECULIAR FEATURES OF THE BOTTOM-LANDS.

About the middle of September, 1871, I visited Foote's Pond, in Posey County, Indiana, and in company with my botanical friend Dr. Jacob Schneck, of Mt. Carmel, Illinois, spent a day in exploring

its vicinity. This pond is a fine representative of a peculiar feature of the bottom-lands of the western and southern rivers, locally termed bayous,* lagoons or ponds, and in all essential respects is like hundreds of others in the alluvial bottoms of the lower Wabash. Following an old, almost abandoned road through the primeval forest, guided partly by the directions of the people in the neighborhood and partly by the memory of Dr. S. who had been there several years before, we at length discovered, by an opening in the tree-tops, the close proximity of the pond. As we emerged from our tiresome passage through the tangled thickets of button bush (*Cephalanthus occidentalis*) which filled up that end of the pond and grew about 10 or 12 feet high, and stood upon its bank, a beautiful view opened before us. Entirely hemmed in by the surrounding dense forest which extended for miles in every direction, and into whose depths the fronting screen of rank and varied undergrowth prevented the eye from seeing — hiding even the trunks of the foremost rank of trees, there stretched away from us a narrow sheet of water, the calm surface of which was studded with a variety of beautiful aquatics, and its shores ornamented by a belt of extremely diversified herbage, which for variety and luxuriance we have nowhere seen surpassed outside the tropics. Along the shallow margins of the pond were acres of the magnificent *Nelumbium luteum*, its broad circular leaves supported on upright stalks, 2 to 4 feet high, and appearing like a plantation of vegetable parasols, or else resting upon the surface of the water, with the stalks submerged; the wet banks, from which the water had gradually subsided during the summer by evaporation and absorption, were covered by a rank and varied vegetation consisting mainly of *Polygonaceæ*, — among which the drooping racemes of rose-colored or carmine flowers of the *Polygonum amphibium* gave a gay and prevalent color, — and of tall and beautiful grasses and sedges of numerous species; while mingled with these prevailing forms grew, in the moister spots, patches of plants with striking and beautiful foliage and often handsome flowers as the Sagittariæ, and Heteranthera with white flowers, Pontederia with similar habit and blue flowers, Echinodorus, "blue-eyed grass" (*Sisyrhynchium Bermudianum*), tufts of flags (Iris), etc. As we passed along, wading knee-deep, sometimes waist-deep, through this rank herb-

* Pronounced bi-o.

age — often overtopped by tall stalks of marsh mallows (*Hibiscus Moscheutos* and *H. militaris*) bearing large and showy white or rose-colored flowers — we finally found a canoe tied to a willow tree on the bank; this we appropriated for the purpose of investigating the pond itself, and accordingly launched out upon the flower-studded water. We paddled smoothly along at first, over the still, deep water, almost coffee-colored from the decomposition of vegetable matter, but still transparent, and looking down into its depths we could see only a tangled mass of submerged weeds of a moss-like or stringy form; then we brushed through water-lilies and, reaching out, plucked the beautiful snow-white, fragrant flowers of the lovely water nymph (*Nymphæa odorata*) or the yellow ones of the more unpretending "spatter-dock" or yellow pond-lily (*Nuphar advena*). Little yellow, star-like flowers resting on the surface of the water, with their cypress vine-like leaves submerged, were found to be the *Cabomba Caroliniana*, a common aquatic of the Gulf States, and not before found beyond them; while very curious peltate leaves, looking somewhat like miniatures of the great lotus or "yonkapins" (Nelumbium) beside them, but less circular in outline, were *Brasenia peltata*. As we passed plants of the Nelumbium, our canoe would now and then brush against the edge of one of their floating circular leaves, and set it revolving on the water like a wheel. Many leaves of this latter species which we measured were found to be 3 feet in diameter; this species was not then in flower, the blossoms having developed into those peculiar "toruses," or top-shaped seed-cones, containing the edible, acorn-like seeds. Often we had the greatest difficulty in poling our canoe through the intricately tangled mass of floating and submerged weeds,* which appeared to be in almost endless variety, and among which we recognized, besides the species already mentioned, various species of Utricularia, Podostemon, Lemna, Wolffia, Potamogeton, Limnobium and Spongia. Having satisfied ourselves with our examination of the pond itself, we then took leisurely views of its banks, as we passed along over the water. A fronting growth of graceful willows, 20 or 30 feet high, formed the most prominent feature of the shore vegetation, and in the arms of the pond a jungle of Cephalanthus of a lower and denser growth,

* In this connection it may be well to mention that this pond received its name from a Mr. Foote, a surveyor, who attempted to swim across the pond with a surveyor's chain in his hand, and becoming entangled in the submerged weeds was drowned.

with the lower branches bearded with black moss-like pendent tufts of Ramalina. Back of this, on every side, stood the dark tall wall of forest, against which the white arms of the huge old sycamores shone out in striking relief by the strong contrast. Arriving at the shore, and going out into the woods, we found them to be almost completely primitive in their condition, and so dark and silent that one could easily imagine himself in a wholly uninhabited region, there being few traces of the work of the axe, which mar so sadly the beauty of the forests in more thickly settled districts. The fine old trees still stood in all their majesty, above the luxuriant and tangled undergrowth of a virgin forest. The largest trees were, of course, the gigantic sycamores (*Platanus occidentalis*) with trunks 25 to 30 feet in circumference, and of varying length, and a total height of 160 to near 200 feet; but the bur oak (*Quercus macrocarpa*) was very abundant, and had attained an unusual size, very many trunks measuring 18 or 20 feet in circumference, above the larger base, and supporting a wide-spread head of astonishing massiveness. Nowhere else had we seen the sweet gum (*Liquidambar styraciflua*) growing in greater abundance and to such magnificent proportions. In the damper parts of this forest it formed the prevailing growth and seemed to vie with the majestic pecan (*Carya olivæformis*) in its towering height, and on the tall, slender, and perfectly straight trunk, supported a spreading, umbrella-shaped top. Many of these gum trees were, no doubt, 180 feet, or probably more, in height, while the longest shafts appeared to considerably exceed 100 feet in length, and were 16 or 17 feet in circumference. The white elm (*Ulmus Americana*) and honey locust (*Gleditschia triacanthos*) also approached the sweet gums and pecans in size; the height of the largest individuals being carefully estimated at 130 to 150 feet, while their girth, where the trunks became cylindrical, was found by actual measurement to be often as much as 17 feet. Most of the trees of these two species had their branches matted with the parasitic mistletoe (*Phoradendron flavescens*) which plant evinces in this region a striking partiality to these trees. The beautiful catalpa, or "cigar tree" (*Catalpa bignonioides*), grew as a common species among the underwoods and attained a common size of 60 feet in height and over 2 feet in diameter; its foliage was very luxuriant, a leaf plucked from a large tree measuring 18 inches in length by 13 in breadth. The other underwoods were

chiefly pawpaw (*Asimina triloba*), mulberry (*Morus rubra*), sassafras (*Sassafras officinale*), red-bud (*Cercis Canadensis*), iron woods (*Carpinus Americanus* and *Ostrya Virginica*), mixed with numerous other smaller trees, as *Amelanchier Canadensis*, wild plums, crab apple (*Pyrus coronaria*), several species of haws or thorn apples (Crataegus), flowering dogwood (*Cornus florida*), black haw (*Viburnum prunifolium*); while the shrubby undergrowth, which was frequently too dense to penetrate without cutting, consisted in the main of prickly ash (*Xanthoxylum Americanum*), hop tree (*Ptelea trifoliata*), bladder nut (*Staphylea trifolia*), burning bush or "Wahoo" (*Euonymus atropurpureus*), *Crataegus spathulata** and several species of Cornus, besides numerous other shrubs. The prevalent undergrowth, however, consisted of spice wood (*Lindera benzoin*) which grew 10 or 12 feet high, its branches often forming a complete canopy overhead, which entirely shut off the view of the tree-tops.

In the "hollows" parallel to the river, the small cane (*Arundinaria tecta*) formed dense brakes and grew 10 or 12 feet high, the canes matted with thorny "green brier" (Smilax several species) and mixed with tall stinging nettles (Utrica and Laportea); or where the cane was scant or absent, the ground bristled with *Equisetaceæ*. In the more open portions of the woods the herbaceous vegetation was more luxuriant, consisting, in the main, of rank nettles (Urtica and Laportea), tall iron weeds (Vernonia) and silk weeds (Asclepias), associated with an apparently infinite variety of other weeds of similar habit.

In lower spots the "lizard-tail" (*Saururus cernuus*) was the predominant plant, and when in flower imparted a pleasing fragrance to the locality. In the more open glades numerous vines flourished in great luxuriance; grape-vines (of half a dozen species) canopied with their foliage the smaller trees, or ascended to the tops of the very tallest. The winter grape (*Vitis cordifolia*) often grew to a great size, many vines measuring 24 and some 40 inches in circumference several feet from the ground,—sometimes dangling from a branch a hundred feet overhead, as often stretching like a cable from one tree to another, or twisted in fantastic and intricate contortions as they wrapped the trunks or swayed from them. The gaudy trumpet creeper (*Tecoma radicans*) with its vivid clusters of large and conspicuous tubular orange-red

* Heretofore considered of more southern habitat.

flowers accompanied the grape-vines in their riot among the branches, or with the luxuriant poison vines (*Rhus radicans*) adorned the trunks; it was growing to a remarkably large size, a trunk of this species which we measured being 41 inches in circumference at several feet from the root. The splendid *Wistaria frutescens* climbed up the trees and draped their branches; the graceful cross vine (*Bignonia capreolata*) crept perpendicularly up the larger trunks, its dark green, lanceolate leaves, arranged symmetrically in right angles with the stem, and its clusters of trumpet-shaped carmine and yellow flowers, or long pendent pods, the flowers being then nearly all gone, rendering this fine creeper an object of striking beauty. The old decaying trunks, on every hand, were encased in a thick matted covering of the Virginia creeper (*Ampelopsis quinquefolia*), and appeared like huge columns draped in green. Smaller woody vines, as the *Cocculus Carolinus*, moonseed (*Menispermum Canadense*), waxwork (*Celastrus scandens*), green briers (*Smilax rotundifolia*, *S. glauca*, *S. tamnoides*, *S. Walteri!* *S. lanceolata!* and perhaps one or two other species), pipe vines (Aristolochia) and many others screened the shrubbery or festooned the underwood, while a great variety of herbaceous vines, far too numerous to name in full, trailed over the undergrowth or ran up the shrubbery. Chief among these were the virgin's bowers (*Clematis Pitcheri*, *C. viorna* and *C. Virginiana*), the yellow passion flower (*Passiflora lutea*), wild cypress vine (*Quamoclit coccinea*), wild blue morning glory (*Ipomœa nil*), Rutland beauty (*Calystegia sepium* and *C. spithamea*) balsam apple (*Echinocystis lobata*), wild hop (*Humulus lupulus*), wild yam (*Dioscorea villosa*) and carrion flower (*Smilax herbacea*). Besides these were the several species of dodder (Cuscuta) which spread a carpet of orange-colored yarn, as it were, over the herbage, and numerous species of delicate *Leguminosæ*, with handsome pea-like flowers, nestled meekly beneath the ranker herbage, or accompanied the other vines in their spiral ascent. Very often the smaller vines twined around the larger; and in one instance we noticed five species thus ascending one tree. They were *Rhus radicans*, *Tecoma radicans*, *Smilax rotundifolia*, *Celastrus scandens* and *Menispermum Canadense*.

In this neighborhood we found no cypress swamps and did not hear that any occurred there. But about twenty or thirty miles to the northward, just across the mouth of White River and on the

point of land known as "the neck" between that stream and the Wabash, is a cypress swamp of very considerable extent, embracing, according to the report of the Indiana Geological Survey (p. 179), an area of 17,000 acres! I have visited this swamp, but as yet have only just entered its borders, a penetration into its centre being almost a matter of impossibility; and, if possible, is attended by great difficulties and fatigue. In June and July, 1871, I made several attempts to explore to my satisfaction these cypress ponds, but partly from want of familiarity with the locality, and partly from the great difficulties encountered in penetrating the almost impassable undergrowth and débris, became tired out before I had fairly found myself surrounded by cypresses. In these swamps, the bald cypress (*Taxodium distichum*) is, of course, the prevailing growth; but the gigantic pillars of this species overtop a smaller growth of such trees as *Nyssa uniflora*, *Liquidambar styraciflua*, *Gleditschia monosperma*, and such others as require a boggy situation. Though the finest accessible trees of the cypress had been long destroyed, there were yet a few standing which appeared to approach, perhaps to exceed, 150 feet in height, while there were trunks, with immense conical bases, more than 10 feet in diameter. I have no doubt, however, that the almost inaccessible recesses of the swamp contain trees of this species of far greater dimensions. In the portion of the "swamp" which I was able to penetrate, the ground was not overflowed, but moist, or in a few spots boggy, with now and then a lagoon of clear water — clear of trees, but filled up with aquatic plants. One must penetrate such a place before he can appreciate its difficulties; then before he has penetrated fifty feet he is likely to have stumbled over a dozen logs, butted, every few steps, against a cypress "knee" concealed in the rank weeds, and thereby tumbled head-foremost into a thorny bush, or mired in the black mud. After such an experience, stopping on a prostrate log to rest, I prepared to contemplate my surroundings as calmly as I could while wiping the sweat from my eyes, and panting with the rough treatment I had met. Except upward, a view in any direction could not possibly extend beyond a few rods. The tall cypresses stretched their arms overhead, though often they were concealed by the intervening growth of smaller trees, or by the close canopy of button bush (Cephalanthus) and spice wood (Lindera). The fallen trunks, in every position, from an angle of

45°, as when arrested in their fall by another tree, to the prostrate log, were in every stage of decay. Some, as they lay rotting on the damp ground, were as high as the head, and all completely overspread by a varied growth of weeds, which here take a hold upon every available spot, covering as completely the logs and rubbish as they do the ground.

Emerging, in a somewhat dilapidated condition, from this underwood, a beautiful and entirely different scene lay before me; a "pond," but instead of a sheet of dark stagnant water, there spread out before me a sea of green vegetation, with the grasses and sedges waving, and the Nelumbiums nodding, in the gentle breeze, while the graceful, delicately foliaged willows, which fringed its borders, swayed with every impulse of the wind. Above the latter reached upward the spires of the tall cypresses, which stretched out their arms, clad in their fine light green feathery foliage; but even these were overtopped by occasional gigantic sycamores which overlooked the entire forest, stretching out for miles on every side. This pond, which occupied an area of about a mile and a half in length by a maximum breadth of perhaps half a mile, was at this time nearly dry, in consequence of the protracted summer's drought. The bed from which the water had entirely disappeared was covered with a luxuriant growth of handsome and varied species of grasses and sedges, while in the damper spots stood tall blades of Scirpus and Typha; and, in the dryer places, patches of tall marsh mallow (*Hibiscus militaris* and *H. Moscheutos*). Toward the centre of the pond the ground grew gradually moister, and sustained a growth of Pontederia, Sagittariæ, etc., then miry, and supporting the broad circular leaves of Nelumbium, and finally formed pools of shallow water, filled with Nuphar, Nymphæa and other plants, which, being inaccessible to us, we could not determine. As we walked along, about knee-deep in the grasses and *Polygonaceæ* of the dryer border of the pond, we shot a large specimen of *Nerodia erythrogaster*, as it lay on the black mud, from which I did not distinguish it until almost stepped upon. As the moister portions were neared, the great blue herons (*Ardea herodias*) would fly up, startling the intruder with their horridly discordant squawk, sometimes accompanied in their retreat by great white herons (*Herodias egretta*); and once a flock of a dozen or twenty wood ibis (*Tantalus loculator*) were disturbed in their rest upon the branches of an old dead sycamore

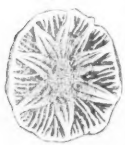
that overhung the bank, by a shot which we hazarded at some as they flew from a pool a hundred yards or so ahead of us. In the solitude of such places as this, these birds find secure retreats; and from the half dried-up pools have their fill of fishes, crustacea and reptiles which, when the water becomes nearly exhausted by the summer's drought, are so numerous in the little pools to which they are confined as to keep the water in constant agitation.

THE CALIFORNIAN TRIVIA AND SOME POINTS IN ITS DISTRIBUTION.

BY ROBERT E. C. STEARNS.

In the month of March, 1868, Mr. W. G. W. Harford and myself made a short visit to Monterey for the purpose of collecting, devoting most of the time to an investigation of the outer or ocean shore of Point Piños in the vicinity of the lighthouse. Here are great numbers of granite boulders which have been thrown up by the sea; by wading in at low tide to a depth of two or three feet, and conveying to the shore such stones as could be lifted by us, we were able to make a deliberate and careful examination. Upon the under side of some of the heavy boulders, we found numerous colonies of the corals, *Paracyathus Stearnsii* and *Balanophyllia elegans* (Fig. 144), described by Prof. Verrill of Yale; when first taken from the water and therefore alive, these corals are of a beautiful red color, a shade between orange and scarlet, and vivid as a coal of fire; when dead the stony portion soon fades and becomes a dingy white. Upon these brilliantly colored coral animals, the animal of *Trivia Californica* (Fig. 145, shell, enlarged twice) subsists, at least in part, for I cannot assert that it does not, like other Californians, seek a variety in its bill of fare, and it is not unlikely that it feeds sometimes upon the jelly-like portion of the living sponges.

Fig. 144.



Balanophyllia.

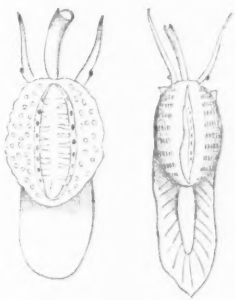
Fig. 145.

Trivia, shell.

The animal of *Trivia Californica* (Fig. 146, enlarged twice) is of the same color as the animal of *B. elegans;* the mantle and

body a vivid orange-scarlet; the body proportionally very much shorter posteriorly and narrower than in *Trivia Europæa* Mont. (Fig. 147, natural size), as figured in Adams' Genera, Vol. iii, pl. 28, fig. 5; towards and at the end of the proboscis, the color tones into a reddish-brown; the eyes are upon slight protuberances upon the outer base of the tentacles; the color of the mantle (which is quite thin and almost transparent) when extended over the back of the shell is neutralized by the purple color of the latter, and the edge of the mantle appears to be slightly waved, and is alternately closely dotted with small whitish and brownish spots; small whitish papillose spots may also be seen irregularly placed on the surface and sides of the mantle; the animal is quite active; from a fancied resemblance to beans, our Spanish Californians residing along the coast call the shells which they frequently find on the beaches, "frijoles." The Trivia is also found in the Gulf of California.

Fig. 146. Fig. 147.



Trivia Californica. Trivia Europæa.

An interesting fact pertaining to the distribution of this and quite likely other related species is worthy of notice. Bodega Head, where in June, 1867, accompanied by Dr. W. Newcomb, I made a collection, is about one hundred and forty miles north of Point Piños, and consists of an abrupt but not very extensive outcropping of coarse granite similar to the rocks of Point Piños; at Bodega I detected the same species of corals and the Trivia, subsequently collected at the Monterey station; the corals seem to affect the harder rock, for at the intervening points where I have made collections, I have been unable to find either of the corals or a solitary Trivia, the coast being composed almost exclusively of the sedimentary rocks.

The common shore shell, *Littorina planaxis*, also appears partial to the granite, though sometimes found on the shales.

From the above it may be inferred, other requirements being present, especially the proper temperature of the water, that the occurrence of the corals is coincident with the presence of the granite, that of the Trivia with the corals upon which it feeds;

it may be that the Littorina, the animal unlike that of the Trivia being a vegetarian, finds its favorite food in some marine vegetable form peculiar to the granite, or that some form of vegetation, which grows upon the shales as well as the harder rock, has some quality imparted to it by the granite which renders it more palatable to the Littorina, and hence its apparent preference for a granitic habitat or station.

THE ALPINE FLORA OF COLORADO.

BY REV. E. L. GREENE.

By means of the collections made and distributed a few years since by Dr. C. C. Parry and Messrs. Hall and Harbour, the botany of the Alpine region of the Rocky Mountains is very well represented to the few who have been able to avail themselves of sets of specimens made by these collectors. Dr. Parry has been collecting in this region again during the past season, and will probably soon be ready to distribute sets that will very beautifully represent this Alpine flora of our West. For the pleasure of many interested parties, who may fail to procure these rare and valuable collections, we purpose giving, through our common friend the NATURALIST, a brief sketch of some of these beauties of the higher mountains, as they appear to one who has more than once visited them in their Alpine homes.

At the altitude of nearly eleven thousand feet, as one passes upward among the pines and spruces which become more scattering in numbers, and more and more dwarfed in stature, because we are rapidly approaching the limit of trees, no one who notices flowers will fail to observe first of all, the brilliant painted cup (Castilleia), the scarlet flowered varieties of which might at first be mistaken for the common *Castilleia coccinea*. But this plant is of a quite distinct species; and notwithstanding the exceeding brightness of its flowers, at this particular altitude, passing as they do into almost every possible shade of red, and sometimes to a beautiful mauve or purple (so that it is difficult to find two different roots producing the same color of flower), its true name is

Castilleia pallida, or pale painted cup; for in the marshes below, say at an altitude of seven thousand feet, and from that point upwards to near the timber line, wherever the plant grows, it bears handsome pale cream-colored flowers. Also above the timber line where it again appears and continues in a very reduced form to flourish at twelve thousand feet, the flowers are pallid again, though with a more decidedly yellowish cast, in the very dwarf and high-alpine variety.

One seldom meets with such exceedingly beautiful wild flowers as are found in just this region of the last of the trees. From their sources on the borders of snow fields just above, noisy streamlets come dancing down, their banks often fairly crowded, and their foaming waters hidden by the luxuriant foliage, and pendent blue flower-clusters of *Mertensia Sibirica*. Where the stream is broader and the water shallow, the splendid *Primula Parryi* almost startles you as you come suddenly upon it, so tropically rich are its light green, showy leaves, and its heavy umbels of large, magenta-purple flowers. Altogether the finest plant of the Rocky Mountains, it seems almost strange that it should have selected its home so near the everlasting snows, and in a region so remote from the haunts of men. It grows usually in thick clumps, in the midst of shallow parts of the streams, its roots running down among the rocks; though sometimes we have found it in very wet, shady ground away from the running waters.

Saxifraga punctata, with very fine roundish leaves, and elegant panicles of pinkish flowers, usually grows in the shallow streamlets with this beautiful Primula, and also *Mimulus luteus*, well enough known in some fine cultivated varieties. In wet shade at about this altitude we find plenty of *Caltha leptosepula*, calling to mind the marsh marigold so abundant in wet meadows on the other side of the Mississippi; but this Alpine species bears only one flower to a stem, the color of which is bluish outside and white within. Nor must we omit to mention the beautiful perennial larkspur (*Delphinium elatum*), whose deep blue spikes are another decided ornament to this region; nor the two very pretty purple-flowered species of Pedicularis (*P. Groenlandica* and *P. Sudetica*); nor *Parnassia fimbriata* with its beautifully fringed white petals.

In drier soils, among the now dwarfed and scattering pines (*Pinus contorta* and *P. aristata*), we find plenty of a very pretty, small, blue-flowered Polemonium (*P. pulchellum*), and likewise a

variety of *Eriogonum umbellatum*, with cream-colored umbels. And here we must leave unmentioned almost countless species and varieties of Senecio, several interesting saxifrages and crowfoots, and daisy-like Erigerons, and pass upward toward the snows. Leaving below the last of the stunted specimens of spruce and pine and rising to those vast, treeless, grassy slopes that lie just above the limit of trees, we enter upon a new field. Woody plants are yet represented by straggling willows of several species, growing possibly to the height of one or two feet, and often monopolizing considerable tracts of land. One may chance also to find a patch of the rare, high-alpine laurel, attaining a height of perhaps one inch, but bearing beautiful large red flowers. This is supposed to be a form of *Kalmia glauca*. It is however seldom met with. Of herbaceous flowering plants, here at an altitude of twelve thousand feet, there yet remain some splendid examples. *Polemonium confertum*, in its typical form, is one of the finest of this handsome genus; yet this is surpassed by a variety (*P. confertum*, var. *mellitum*) of the same species. The first mentioned form, growing on bleak, open ground, either level or sloping northward or westward, is smaller every way, except in the dark-blue corolla. The variety grows taller, has a luxuriant foliage, and usually pale or almost white flowers. It has gained some excellent points of character by selecting for its abiding places the shelter of high rocks, on the south sides where it is well protected from cold winds and driving storms of snow, which not unfrequently visit these sublime heights, even in August, the flower month; and that, to the greater inconvenience of flower gatherers, than of the flowers themselves. The largest plant of these altitudes is a coarse, hoary composite (*Actinella grandiflora*), growing some eight or ten inches high, and producing heads of yellow flowers as large as those of the wild sunflower of the plains. Here, where so few things rise to the height of more than two or three inches, this species becomes very conspicuous. It usually grows on very exposed situations, and the large heads of flowers, borne upon stout and well clothed stems, turn their backs to the storms, and remain stoically indifferent to the peltings of every sleeting blast that sweeps over their dreary abode. *Mertensia alpina* is one of the most elegant of these tenants of the heights. With its stems, three or four inches high, bearing bunches of deep blue, nodding flowers, it looks remarkably pretty,

and is withal quite showy among so many plants of smaller growth. Here we find two very interesting Alpine clovers, *Trifolium dasyphyllum* and *T. nanum*. The former is much reduced in size, the stems, two or three inches high, supporting the large heads of pink and purple flowers, are conspicuously longer than the leaves. *T. nanum* grows chiefly on very bleak and barren summits, and is yet far smaller. It can scarcely be said to have even a flower-stalk. The flowers, too, are not produced in heads as in other species, but grow either singly, or two together; they are very large, of a pink color, and lie as closely as they can to the matted leaves. The pale green spreading masses of the minute *Phlox Hoodii*, when out of bloom, would very likely be passed by for patches of moss; but now they are dotted all over or fairly whitened with pink-eyed flowers, and are perfectly charming. *Silene acaulis* is another of these matted, mossy, Alpine beauties, with almost stemless, purple flowers. *Saxifraga serpyllifolia*, almost the smallest saxifrage one meets with here, has remarkably large, golden-yellow petals. And now, just a little above us, begin the long, white lines or extended fields of never-melting snows. We hasten to their borders, curious to see what floral beauties have chosen to bloom there; and we find not a few very notable ones.

Within six feet of the snow grows the small but bright-eyed and pretty *Primula angustifolia; Lloydia serotina*, a rather small liliaceous plant, with solitary white flowers; *Gentiana frigida*, a handsome gentian with large corollas, white, marked and speckled with blue, and which are not afraid to expand. *Eritrichium aretioides* is a most elegant, forget-me-not-like plant of about this altitude, growing in very small, silvery masses and sending out very short stems with the very prettiest bright blue flowers. The showiest of all is *Ranunculus adoneus*, a crowfoot with rather stout stems, small and finely divided leaves, and remarkably large and well-formed golden petals. It is certainly one of the very finest species of its genus, and even shows some inclination to produce double flowers. Snow banks that are shut in closely by high surrounding mountains seem as if bordered with gold by the abundance of this plant.

On yet higher and drier points are many more very interesting species, of which we will speak of one here and there. Among some of the highest cliffs one finds in the crevices of the rocks a beautiful small-flowered columbine, a variety of *Aquilegia*

vulgaris. *Claytonia Arctica*, var. *megarhiza*, with large tufts of broad, fleshy leaves, grows on some very barren summits among the rocks, and by the freshness of its appearance in such a place, away above the range of the most dwarfed of high-alpine plants, almost astonishes you. The flowers are quite similar to those of *Claytonia Virginica*, and the whole plant is rather fine looking. It has a marvellously large fleshy root, from which it was named by Dr. Parry, *C. megarhiza*. A little, yellow-rayed composite, with heads of flowers scarcely raised above the surface of the rocky ground, is *Aplopappus pygmæus;* a pygmy indeed in contrast with some of its kindred species of the lower mountains and of the plains. *A. Lyallii* is another very dwarf, high-alpine species less frequently met with.

Talinum pygmæum is a fine little dwarf, looking very like a Claytonia, but producing among its tufts of narrow fleshy leaves numerous very bright purple flowers.

There remain yet many of these Alpine flowers well worth notice; but we are now far above the "music of the pines," looking downward over many a silvery lake, and over many a wide-extended field of dazzling snow. Eastward lies the blue line of distant plains, and near us in the west are piled range on range of snow-streaked, rocky Mountains. The flowers that bloom at our feet we shall forget a moment, and enjoy the wondrous grandeur of this sublime landscape into which our botanizing has so delightfully led us.

CERTAIN PECULIARITIES IN THE CRANIA OF THE MOUND-BUILDERS.

BY J. W. FOSTER, LL. D.*

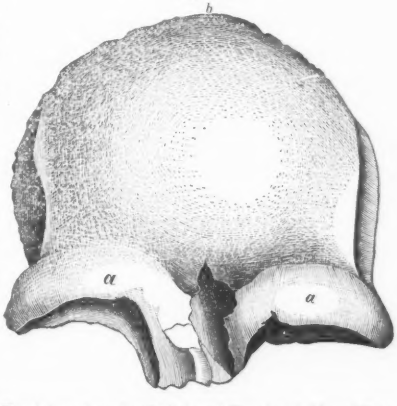
THE "Kennicott Mound," near Chicago, yielded three frontal bones — the only parts of the skeletons capable of preservation —

* An abstract of a paper read before the Dubuque Meeting of the American Association for the Advancement of Science, Aug., 1872.

After giving an account of the several skulls that he had examined from mounds in Indiana, Illinois and Iowa, with a comparison of them with various other skulls, illustrated by a number of drawings, Dr. Foster gives his conclusions regarding the distinctive characters of the crania of the mound-building race, which we quote entire, preceded by a copy of a drawing of the singular skull from the "Kennicott Mound," and his remarks upon it. We regret that we are unable to print the paper in full, but we trust that it will soon appear in the volume of the Proceedings of the meeting. — EDS.

which were also indicative of a low type. In two instances there was a rapid narrowing in the temporal region; the plates were extraordinarily thick; the superciliary ridges were massive, standing out like ropes; the orbital processes were profoundly notched; and the frontal bone was much prolonged towards the coronal suture. Figure 148, reduced one-half, represents one of these bones. No one, I think, can view this fragment of a skull with its superciliary ridges projecting far beyond the general contour both laterally and in front, and the low flat forehead with its thick, bony walls, without coming to the conclusion that its possessor was a ferocious brute. The prize-fighter of this day might envy such a frontispiece, adapted to withstand any degree of pommelling, or almost even to turn a musket ball.

Fig. 148.



Frontal portion of a Skull from "Kennicott's Mound," near Chicago. *a*, *a*, Superciliary ridges.

Distinctive Characters. — The skulls which I have described possess peculiarities which ally them more nearly with the Mongolian race than with the negro or European. They belong in one respect to what Dr. Pritchard calls the *Pyramidal type*, but in other respects they present characters which are *sui generis*. The pyramidal form, seen in cross section, arises from the peculiar conformation of the malar bones, giving an outward sweep to the zygomatic arches.

I append a synopsis of what I regard as the distinctive characters of the Mound-builder's skull, selecting for the purpose the one represented by Fig. 149, which belongs to neither the lowest nor the highest forms; and that the reader may compare these peculiarities with those of the idiot as given by Humphry, I shall, as far as convenient, follow his order of description. It is to be regretted that in all my specimens, with a single exception, the facial bones are wanting.

In examining this skull in its general outlines the observer is struck by the scantiness of brain capacity, seen in the narrow forehead, the receding frontal bone, and a similar recession in the region of the lambdoidal suture, which give to the vertex an undue prominence, and to the longitudinal arc an outline approaching in form a Gothic arch.

That portion of the occipital bone behind the foramen magnum,

Fig. 149.

Typical Skull of the Mound-builder.

a, Glabella.
b, Coronal suture.
c, Lambdoidal suture.
d, Occipital crest.
e, Squamosal suture.
f, Foramen magnum.

instead of being continued in a straight line, as in the well-developed European skull, curves up to the occipital crest. The occipital condyles are small, and "the basilar portion of the occipital bone ascends with unusual obliquity from them." "The foramen magnum and the other foramina for nerves at the base are comparatively large; the foramina for vessels as well as the grooves for the sinuses are, on the other hand, comparatively small." The post-glenoid process, as in the negro, is strongly marked. The occipital crest is highly ridged, and arched convexly like the figure ∞, and the point where these arches intersect

forms the extremity of the skull. The temporal fossæ are deep and the temporal ridge is prominent. The apex is about midway between the coronal and lambdoidal suture. The parietal plates instead of swelling into a rounded outline, are flattened. The suture connecting the squamous bone with the parietal is less convex than in the European, and in this respect approaches that of the chimpanzee and the lower animals, which is nearly straight. The superciliary ridges are strongly marked and project beyond the general contour of the brain case, and the glabella forms the extreme point of the anterior portion of the skull. The orbits, where bounded by the superciliary ridges and the nasal septum, owing to the deep supraorbital notch, are of a quadrangular shape. The frontal eminences are very slight, which make the superciliary ridges more conspicuous, and the forehead more retreating. The zygomatic arches swell out beyond the parietal walls, which in the European skull so far overhang as to conceal them in the vertical view. From this point of observation it may be said that all the exterior prominences are visible,—the occipital protuberance, the zygomatic arches, and the superciliary ridges.

The frontal bone is of great strength and slopes backward, encroaching on the parietals and giving origin to a low forehead. In the lower animals this bone becomes nearly horizontal and is placed behind the eyes. "In proportion," says Humphry, "as the cranial portion slopes backward, so do its facial buttresses—the nasal and angular processes—slant forwards; and in proportion as the brain is well developed and the cranial part of the bone is upright, so are the facial processes directed perpendicularly downwards. In the lower animals for instance, they grow directly forwards, in the lower races of mankind they grow downwards and forwards, and in the best formed human skulls they grow almost vertically downwards."

Such are the characters which seem to predominate in the mound-builders' skulls,—characters which distinguish them from the negro on the one hand and the Teuton on the other. Individual variations occur, as might be expected, for we are not to suppose that all have been cast in a single mould. All the specimens indicate a low intellectual organization little removed from that of the idiot.

On comparing the figure with a European skull, these anatomical traits will be apparent by contrast; particularly the increased

development of the frontal and parietal regions, the outward curving of the occiput, the horizontality of the line between the occipital ridge and the foramen magnum, and the convexity of the squamosal suture.

It is the preponderance of the brain case over the facial portion of the head that gives to man his superiority as compared with the lower animals; and we estimate the intellectuality and capacity for improvement in the several races of men by the same standard. The skull in size and outline has a general conformity to the enclosed brain. The bony walls take their shape from the nervous tissue, as the shell of the oyster is shaped to accommodate its living tenant. The brain is undoubtedly the seat of mental activity; and, without endorsing phrenology in all its details, we may affirm that a particular form of skull is indicative of particular traits of character. We place the seat of the intellectual faculties in the anterior lobe; of the propensities which link us to the brute in the middle lobe; and of those which appertain to the social affections in the posterior lobe. The predominance of any one of these divisions in a people would stamp them as either eminently intellectual, or eminently cruel, or eminently social. The mound-builders, assuming these skulls to be typical, were doubtless neither eminent for great virtues nor great vices, but were a mild, inoffensive race, who would fall an easy prey to a crafty and cruel foe. Under the guidance of a superior mind, we can imagine that they would be content to toil, without weighing deliberately the nature or amount of the reward. Like the Chinese they could probably imitate, but not invent; and, secure from the irruption of enemies they would, in time, develop a rude civilization.

The Indian possesses a conformation of skull which clearly separates him from the prehistoric mound-builder. And such a conformation must give rise to different mental traits. His brain as compared with the European, according to George Combe, differs widely in the proportions of the different parts. The anterior lobe is small, the middle lobe large, and the central convolutions on the anterior lobe and upper surface are small. The brain case is box-like with the corners rounded off; the occiput extends up vertically; the frontal ridge is prominent; the cerebral vault is pyramidal; the interparietal diameter is great; the superciliary ridges and zygomatic arches sweep out beyond the gen-

eral line of the skull; the orbits are quadrangular; the forehead is low; the cheek bones high; and the jaws prognathous. His character, since first known to the white man, has been signalized by treachery and cruelty. He repels all efforts to raise him from his degraded position; and whilst he has not the moral nature to adopt the virtues of civilization, his brutal instincts lead him to welcome its vices. He was never known voluntarily to engage in an enterprise requiring methodical labor; he dwells in temporary and movable habitations, he follows the game in their migrations; he imposes the drudgery of life upon his squaw; he takes no heed for the future. To suppose that such a race threw up the long lines of circumvallations and the symmetrical mounds which crown so many of our river-terraces is as preposterous almost, as to suppose that they built the pyramids of Egypt.

In the results of archæological explorations, at other points on this hemisphere, we have evidences of the existence of races whose skulls had many of the distinctive features which appertain to those of the mound-builder.

Dr. Lund, a distinguished Swedish naturalist, many years ago in the bone caves of Minas Gordas, Brazil, found the remains of men associated with those of extinct quadrupeds, under circumstances which led him to believe that the whole were contemporaneous. In his communications to the Geographical and Historical Society of Brazil, an abstract of which was forwarded to Dr. Morton by Lieutenant Strain, he says:

"The question then arises, who are these people? Of what race, and what their intellectual perfections? The answers to these questions are, happily, less difficult and doubtful. He examined various crania in order to determine the place they ought to occupy in anthropology. The narrowness of the forehead, the prominence of the zygomatic bones, the maxillary and orbital conformation, all assign to these crania a place among the characteristics of the American race, and it is known that the race which approximates nearest this, is the Mongolian; and the most distinctive and salient character by which we distinguish between them is the greater depression of the forehead in the former. In this point of organization, these ancient crania show not only the peculiarity of the American race, but this peculiarity, in many instances, is in excessive degree, *even to the entire disappearance of the forehead.*"

"We know that the human figures found sculptured on the ancient monuments of Mexico, represent, for the greater part, a

singular conformation of head, being without forehead, the crania retreating backward immediately above the superciliary arch. This anomaly, which is generally ascribed to an artificial disfiguration of the head or taste of the artist, now admits of a more natural explanation, it being proved by these authentic documents, that there really existed in this country a race exhibiting this anomalous conformation. The skeletons which were of both sexes, were of the ordinary height, although two of them were above the common stature. These heads according to the received opinion in Craniology, could not have occupied a high position intellectually."*

Rivero and Tschudi, whose researches in South America command confidence, believe that the artificial disfigurement of the skull which prevailed amongst the Inca-Peruvians owed its origin to the prior existence of an autochthonous race having this peculiarity; and they further state that it is in some instances congenital, as it is seen in the fœtus of Peruvian mummies.

In the Peruvian skull figured by Tiedemann, this peculiarity is also represented.

These authorities would indicate that there was a conformity in the craniology of the earlier races on this hemisphere, embracing the primeval people of Brazil, the platform-builders of Peru and Mexico, and the mound-builders of the Mississippi Valley.

The Peruvian skull, as compared with the Indian, is deficient in capacity being, according to Morton, no greater than that of the Hottentot or New Hollander. In measuring 155 crania of the former, they gave but 75 cubic inches for the bulk of the brain, while the Teutonic crania gave 92 inches. The average difference between the Peruvian and Indian is 9 inches in favor of the latter.†

How is it then, it has been asked, that with this low mental power, these Peruvians should have been able to construct such stupendous works, and develop a very considerable civilization, while the Indian, with far greater volume of brain, exhibits such slight constructive power and has resisted all attempts to elevate his condition? Mr. J. S. Phillips has attempted to answer this question:

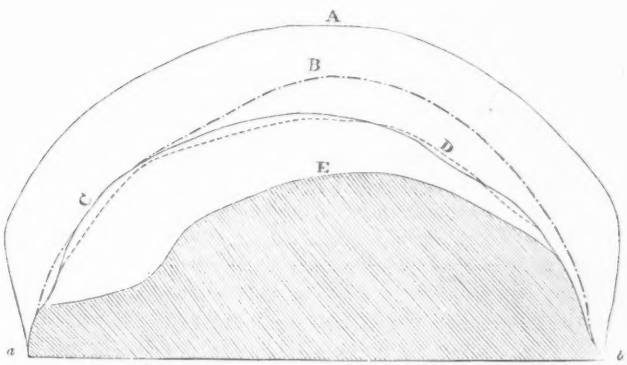
"The intellectual lobe of the brain of these people, if not borne down by such overpowering animal propensities and passions, would, doubtless, have been capable of much greater efforts than any with which we are acquainted, and have enabled these barbaric tribes to make some progress in civilization. * * The intel-

* Jour. Acad. Nat. Sci. Phila., 1844. † Morton's "Crania Americana."

lectual and moral qualities of the Mexicans and Peruvians are left more free to act, not being so subordinate to the propensities and violent passions.*

Below, I give the contours of the most anomalous skulls referred to in this paper, reduced to a uniform scale:

Fig. 150.



Comparative size of different skulls.

A. Contour of European Skull.
B. " " that from Stimpson's Mound No. 1.
C. " " that from the Neanderthal Skull.
D. " " that from the Dunleith Mound, No. 9.
E. " " the Chimpanzee.
a. The glabella.
b. The occipital crest.

So great is the range of variation in the crania of the living tribes of men that it is unsafe to pronounce upon their average capacity except from an examination of a large collection. Thus far but few authentic mound-builders' skulls have been exhumed, and they indicate that that race must be ranked intellectually below the lowest types of Australia and Caledonia.

Leaving out the Eagis skull which shows a good degree of intellectuality, it may be said that the earliest types of man are inferior, as indicated by the Neanderthal skull, as well as by those recovered from the Danish and British tumuli, to say nothing of the strange human jaw found by Dupont in Belgium, which approaches

* Appendix to Morton's "Physical Type of the American Indian."

those of the anthromorphous apes, and another jaw of analogous traits found by the Marquis de Vibraye in France, both of which are supposed to be referable to the dawn of the human period. There is nothing to indicate modern degeneracy, whether applied to the intellectual or physical capacity of the Teutonic race. So far from it, there are strong grounds for believing that our remote ancestors lived in brutal barbarism, with modes of thought and daily pursuits far different from those of the educated and much-planning man of to-day; and that, through a state of progression, long continued, often checked, but still acquiring strength to advance, a portion of the human family have been able to attain a high degree of civilization — civilization which implies intellectual culture and an ability to render the forces of nature subservient to human wants and conveniences.

That the investigator may comprehend the relative rank which the mound-builder occupied in what I may call the scale of humanity, I give the following tables of measurements of the crania of the superior and inferior races of mankind, as they exist at this day; those from the United States being taken from "The Military and Anthropological Statistics of the War of the Rebellion," published by the Sanitary Commission under the editorship of Dr. B. A. Gould, and those from foreign sources being reproduced from Huxley:

TABLE OF MEASUREMENTS.

NOTE. If the hair and scalp were removed, the circumference would be reduced from one to one and one-half inches.	Circ'f. around forehead and occiput.	Distance betw'n condyloid processes.			Perp'dr from eyebrows to occipital crest.
		Over forehead and occiput.	Over top of the head.	Over occiput.	
White Soldiers	22·13	11·31	13·31	11·82	14·48
Iroquois	22·48	12·08	13·71	11·58	14·45
Mulattoes	22·00	12·34	14·11	12·24	13·55
Negroes	21·91	10·98	13·95	11·55	14·40

In the following table, while giving the measurement of English and Australian skulls, as well as of those known as the Engis and

Neanderthal skulls belonging to a prehistoric race, I also append, for the purposes of comparison, the measurements of the true mound-builders' skulls described in this paper:

TABLE OF MEASUREMENTS.

NATIONALITY.	A.	B.	C.	D.	E.	F.
English	21	13·75	12·50	4·40	7·87	5·33
Australian (No. 1)	20·50	13	12	4·75	7·50	5·40
" (No. 2)	22	12·50	10·75	3·80	7·90	5·75
Engis, Belgium	20·50	13·75	12·50	4·75	7·75	5·25
Neanderthal, Prussian Empire	23	12	10	3·75	8	5·75
Merom, Indiana (No. 4)	20·50	12·87	11·25	4	7·25	5·50
" " (No. 5)	20·62	12·87	12	3·87	7·37	5·37
" " (No. 6)	19·50	12·50	11·62	4·37	6·62	5·62
" " (No. 7)	21	13·50	12·50	4·12	7·12	6
Chicago, Illinois (No. 1)	20·25	12·50		3·80	7·60	5·75
La Porte, Indiana	18·50	10·50	10·30	3·80	6·50	5

A. The horizontal circumference in the plane of a line joining the glabella with the occipital protuberance.
B. The longitudinal arc from the nasal depression along the middle line of the skull to the occipital tuberosity.
C. From the level of the glabello-occipital line on each side, across the middle of the sagittal suture to the same point on the opposite side.
D. The vertical height from the glabello-occipital line.
E. The extreme longitudinal measurement.
F. The extreme transverse measurement.

ON THE RELATION BETWEEN ORGANIC VIGOR AND SEX.

BY HENRY HARTSHORNE, M.D.*

THE observations of Thomas Meehan upon the relations of sex in plants, published in the "Transactions of the American Association for Advancement of Science," and elsewhere, are entitled to the attentive consideration not only of botanists but also of students of general biology. In his papers of 1868, '69 and later, Mr. Meehan has endeavored to show that "it is the highest types

*Read at the Dubuque Meeting of the American Association for the Advancement of Science, August, 1872.

of vitality only which take on the female form."* His facts have referred mainly to *Coniferæ* and *Amentaceæ*, although not confined to them.

The hesitation felt by many minds in regard to the acceptance of the above proposition has originated, chiefly, from the familiarity of the principle that "there is a certain degree of antagonism between the nutritive and the generative functions, the one being executed at the expense of the other;" along with the weight of some very familiar facts concerning the generally greater size and muscular strength of the male among animals (with a few exceptions, as in certain raptorial birds and arachnida), as well as the equally general superiority of male birds in voice and plumage.

Some of the facts in regard to plants cited in the papers referred to may *possibly* bear a different, even an opposite, interpretation to that given by Mr. Meehan. In his example of the larch, for instance, when we notice that after surviving several years of the repeated production of female flowers, the branches or spurs "bear male flowers and die†," is it not possible that the demand for organic force required in the evolution of male flowers *causes* their exhaustion? In another place‡ Mr. Meehan speaks of "the loss of power to branch," which in the Scotch pine, "the formation of male flowers induces." This view might comport, at least, with the ordinary statements of physiologists, as represented by Dr. Carpenter§ who refers to the contrast between Algæ, in which individual construction is especially active, while the fructifying organs are obscure, and fungi, in which almost the whole plant seems made up of reproductive organs, upon the maturing of which the plant ceases to exist. This contrast between nutrition and reproduction appears again in the larval and perfect stages of insect life; the one being devoted to nutrition and the other to reproduction. Is there any doubt that, in the dahlia and other Compositæ *cultivation* alters *fertile* florets of the disk into *barren* florets of the ray? The gardener's common use of the principle of *limiting nutrition for the increase of reproduction* is alluded to by Mr. Meehan in his paper of 1870,‖ in speaking of a branch being "partially *ringed to produce fruitfulness*."

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*Procd. of Am. Assoc. for Adv. Science, 1869, p. 260.
†Procd. Am. Assoc. for Adv. Science, 1869, p. 257.
‡Procd. Acad. Nat. Sciences, Phila. 1869, No. 2, p. 122.
§Principles of Comparative Physiology, p. 147.
‖Procd. of Am. Assoc. for Adv. Science.

But my purpose in the present paper is especially to call attention to a few well known facts in the animal kingdom, of a character somewhat analogous to those dwelt upon above concerning plants; which conspire with these, in suggesting that some qualification or addition may be required to the ordinary statements concerning the relations between nutrition and reproduction; or at least as to those between organic vigor and sex.

Take the instance of the common hive-bee (*Apis mellifica*). According to the observations of Dzierzon, Von Siebold, Leuckart and Tegetmeier upon hive-bees, and of F. W. Putnam, J. Wyman and Gerstæcker upon humble-bees, it appears that there is a regular gradation in rank, so to speak, of bee offspring, according to the method of their production. First and lowest in the hive-bee series are the males or drones. These may be sometimes produced by an unfertilized working bee; commonly, by a queen bee from ova not fertilized with sperm-cells, which cells, as observation and experiment both have shown, may be for a long time detained in the spermotheca charged with them. A queen whose fecundation has been delayed till she is older than usual, is apt to yield only drone offspring. The next stage in rank is that of the worker, or undeveloped female. Every one knows the remarkable effect of nutrition upon its characters; a change of cell and food elevating it to the full endowments of a queen. Putnam and Gerstæcker* have noticed among humble-bees what are called "large queen larvæ," intermediate between the workers and the perfect queens; and Wyman has suggested that the earlier or later period of impregnation may determine this difference; those first impregnated becoming queens, then the large queen larvæ, next the workers, *last the males*.

Now among the Aphides as well as to a certain extent in some Molluscoida, Cœlenterata, etc., we find a class of facts, different from these but yet allied to them. Taking Huxley's summary of the history of aphidian parthenogenesis,† it seems that the number of successive viviparous *pseudovan* broods is "controlled by temperature and the supply of food." The *agamic* viviparous individuals are regarded by Steenstrup and others as *non-sexual*. If sexual, they must be considered as females undeveloped. At all events, the coming on of cold weather begins the production of

* Packard's "Guide to the Study of Insects," p. 119.
† Linnæan Transactions, xxii, p. 198.

males as well as females. Packard's expression is that "the asexual Aphis and the perfect female may be called dimorphic forms." Of the three forms, then, that one whose production especially attends the conditions of the lowest vitality is the *male*.

But another class of facts of a quite different kind may be considered in this connection; involving higher animals and even man himself. I refer to the history of monstrosities. Double monsters (of which some remarkable human instances have been exhibited within a few years in this country) are always of one sex and *nearly always of the female sex*.* There is reason to exclude from this class of true double monsters cases like that of the Siamese Chang and Eng, who may be regarded as really twins with two complete bodies abnormally united together.

Now, why should a double fœtus nearly always have the female sex? The bearing of this question upon that which we have just been discussing appears, when we consider the true theory of double monsters. Under the close investigations of St. Hilaire, Virchow, Vrolik, Fisher and others† it has been made quite evident that they result not at all from the fusion of two embryos into one, but, on the contrary, from the abnormal *fission of a single ovum*, under *excess of formative force*. The point for us now to notice is the nearly constant association of this profusion of developmental force with femininity of sex.

Regarding the actual function of this force (however we may designate it, as, *e. g.*, life force, organic force, bio-plastic force, etc.) as being the formation of plasma with attendant cell-multiplication or *vegetative repetition*, it would appear that *this* is precisely what, in plants and animals, may be the especial feminine endowment. The two directions or modes of manifestation of this organic force are individual construction and reproduction. These may, therefore, be in inverse proportion to each other, simply because the energy or material consumed in the one process is taken from the other; and yet, while a *certain* limitation of food and temperature favors reproduction, rather than individual nutrition and construction, a *greater* lowering of these conditions of vitality will retard, arrest or degrade both processes. According to Meehan's interpretation of his facts concerning plants,

*G. J. Fisher, Trans. Med. Soc. of New York, 1865-1868. Against this I find only a vague expression of W. Vrolik (Cyclop. of Anat. and Physiol., Art. *Teratology*, p. 946) that "some sorts" of double monsters are more frequently male.

†Goodell, Philada. Med. Times, June 15, 1871.

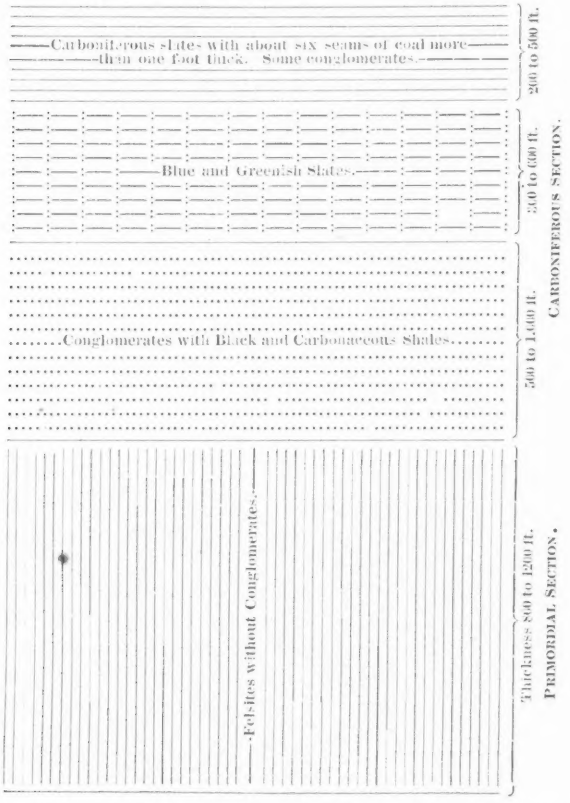
one effect of this lowering, retardation or degradation is the production of the male rather than the female sex. Some facts, at least, in the animal kingdom, as we have seen, support the same view; but to give a statement of this kind the form and validity of a law would require a much more extensive survey of correlated facts. At all events, we do not find the frequent superiority of the masculine sex in certain particulars in the higher animals necessarily incompatible with this; since this superiority prevails usually in apparatus not of the functions of the *vegetative* or organic life, but of *animal* life or of relation; as of *intellection*, *motor* power and *voice*. Beauty of plumage in birds, while we naturally attribute to it a certain superiority, may not, in the scientific sense, unequivocally have this character. If it should be conceded that it has, we must then regard its general predominance in males as one of the difficulties in the way, at present, of any extended or final generalization upon the subject. (The remainder of the paper was occupied with the application of the same course of reasoning to the study of the law of increase of human population.)

ON THE GEOLOGY OF THE ISLAND OF AQUIDNECK AND THE NEIGHBORING PARTS OF THE SHORES OF NARRAGANSET BAY. — No. III.

BY PROF. N. S. SHALER.

Physical Conditions of the Carboniferous Time.—The island of Aquidneck is so far separated from the mainland that we cannot directly refer by traced contact any of its rocks to the masses of the shore. It is not difficult, however, to find a dating point in the materials of the island itself. The extensive coal deposits with their abundant carboniferous fossils make us reasonably sure that a large part of the island is composed of rocks which were laid down at the time when the great coal fields of other parts of the continent were being formed. As the rocks of this part of the section are much better determined than those of any other part of the island, it will be well to begin with them and from them to go to those which cannot be so readily placed in their proper positions in the succession of deposits.

Over all the section extending from the Bristol Ferry to the northern end of Lilly pond, we have a set of rocks which must undoubtedly be referred to the carboniferous age, but which vary in some regards from the typical rocks of that age in this country. The exact thickness and the composition of all the members of this series are not easily ascertained on account of the limited nature of exhibitions of strata on the island. The following section is believed, however, to give something like an approximation to the truth:—



The thickness of this section is difficult to determine; the numerous faults which are apparent in the small part of the area of

the island, where they can be well determined, makes it likely that many occur in the region which is so deeply covered with drift that the observer cannot have a chance of measuring the disturbances they produce.

At the time when the carboniferous beds of the uppermost part of this section were formed, the shore at this part of the continent was not far from its present position. The presence of large quantities of conglomerate with water-worn pebbles in the lower part of the same section conclusively proves this point. From the carboniferous sea an arm or bay having a width of from six to ten miles extended to the northward, with considerable variation in width, as far as Worcester. It is evident that this bay was the estuary of a considerable river, probably a stream of far greater dimensions than any of those which now empty into Narraganset Bay. Down this bay there came at successive times large quantities of detrital materials which varied much in character during the two divisions of the period. During the time of the deposition of the conglomerates there was an immense transportation of fragments from some points in the interior to this shore region. The variety in the chemical and mineralogical constitution of these pebbles is, considering the great tendency there is to equalize their characters by metamorphism, exceedingly great. Some of the materials can be recognized as now in position in the region to the northward but by far the larger part are from rocks which do not, so far as known, occur in the neighborhood. The syenite and other felspathic rocks of the Bristol Neck sections are found in abundance. Other types of syenites also occur which cannot be so easily referred to any bed rock; some geologists have found fragments of Lingulæ in argillaceous pebbles of this formation. These are not known to occur in any rocks to the northward nearer than the Champlain region; it is more reasonable to believe, however, that the source of supply of these fossils has long since been destroyed by erosion, than to suppose that they have been transported from so remote a point. It is quite in accordance with what we know of the erosion of these old rocks to suppose that great masses of these fossil bearing rocks may have been in the immediate neighborhood at the time when these conglomerates were formed and yet these fragments in the newer rock remain the only record of their having existed.

In this view of their history, these conglomerate beds become a most important source of information concerning the ancient geology of this part of the continent. The geologist, in studying the character of glacial drift on this island or any other part of the continent, easily becomes convinced that he has in that mass a key to the geology of the country for sixty miles or more to the northward. Much of the rock within that region whence came this débris is now hidden by similar accumulations of glacial materials, so that the most painstaking student may fail to find its true character, but each gravel or boulder bed is a museum wherein the north lying rocks are more or less well represented. By examining a number of such exposures of the drift it is possible to determine with accuracy the range in character of materials which would be found in the region to the northward so far as Worcester or the neighborhood of Boston. In the same way we may interrogate the conglomerate of the coal period in this region for information concerning the character of the materials of that time exposed to erosive action in this part of the continent. The answer to this inquiry is that the surface of the country was then made up of syenites, porphyries, felsites, argillites and related rocks much as at the present day; some of these rocks contained fossils which may well have lived during the primordial time when they were formed. It is perfectly clear, however, that within the region where these pebbles were formed, there were no rocks of Silurian or Devonian age, else their evident fossils would have been preserved as well as the lingulæ in the pebbles of the conglomerate. This argument gives an important confirmation of the view held by some American geologists, but hitherto resting on insufficient foundation, that New England was elevated above the level of the ocean before the close of the Silurian period. As the region between Newport and the Boston and Albany Railroad contains an assemblage of rocks which may be taken as representative of a large part of the rocks of Massachusetts, it may be regarded as probable that we had, at the time when this conglomerate was deposited, the same conditions prevailing among the rocks of that state as now prevail there. The work of metamorphism which has so much affected the character of the rocks of this region was already done at this the beginning of the coal period. The syenites which have been brought to the surface by the old disloca-

tions which have given the character to the topography of New England were already in a position * to be exposed to erosion.

We have already noticed the close similarity observable between the conglomerate of the primordial time and that which has been produced during the last geological period. It is not easy to find any sharp line of demarcation between the characters of these two detrital rocks. The older conglomerate is always more compact and has usually a trace of bedding, though this feature is often wanting. The pebbles are rather more regularly arranged even where the distortion of the pebbles (a point to be treated hereafter) is least or entirely wanting. Traces of an arrangement of the pebbles as if they had been under flowing water are evident. The fact that at certain points the pebbles have had most, if not all, of the sand and clay washed away between them is a strong proof of their having been exposed to a degree of washing which has been unfelt by more modern deposits. The great similarity in the characters of these two conglomerates, the recent glacial and the carboniferous beds, is strong evidence of relation of origin. The conditions under which conglomerates can be formed are few and peculiar; mountain torrents or the sea rolling upon a shore of rock may form very local accumulations of this nature, but mountain torrents can only make band-like beds or heap up their débris in delta accumulations where their rapid streams merge in water of less carrying force. The sea cannot move pebbles except within the narrow range of its breakers; it rarely has tidal currents which can sweep coarse sand along. The only agent we know to have been generally in action on the earth which is capable of moving pebbles in such a manner as to produce broad deposits of boulders is ice. That it is able to do such work is fully shown by the great accumulations of the drift period. The researches of Mr. James Croll have shown that the conditions which were probably instrumental in producing the last glacial period have operated again and again in the past to effect the same result. There are many points in the great geological section which

* Should it be proven that these Rhode Island conglomerates are of the same age as the materials of similar character in the neighborhood of Boston, we may be able to extend much further this system of reasoning. But it is more than likely, as I shall try to show in the discussion of the geology of Massachusetts Bay, that the conglomerates found there are of still earlier age, having probably been formed during the later stages of the primordial time. Should this conjecture prove true the character of the materials composing these beds will prove an even more interesting key to the ancient history of New England.

show, in the character of the deposits or in the physical condition of the boulders they contain, indubitable evidence of some action other than those usually operative on the surface of the earth. Wherever, as in the nägelfluh of Switzerland or other similar accumulations, we have wide extending shells of boulders and gravel, we are clearly justified in suspecting ice action, when, as in all cases of conglomerates of wide geographical extension which I have examined, the pebbles are not formed with the regular outlines which necessarily occur where the shaping of the masses is the result of moving water. We are bound to believe that pebbles of all sizes, which have been worn to their shape by running water, must tend to assume regular forms, the major axis of which will be coincident either with the greater lengths of the pebbles or with their lines of greatest hardness.

In any case the pebbles will generally assume more or less oblately spheroidal forms. On the other hand, materials which have received their shapes under glacial action will generally be free from those results which come from the uniform friction of one pebble against another, inasmuch as such movements will be impossible while the fragments are in the grip of the ice. The nature of the conditions is such that the pebbles will be worn by being held in a fixed position with one side turned to the abrading agent, the others being for the time protected from wear. With the constant changes occurring in the moving ice one pebble will frequently come to have several facets cut upon it in this way, and many pebbles in succession will be subjected to the same sort of wear. In accumulations of unaltered glacial deposits we always find pebbles having this many faceted character which results from the successive wearing. The only difficulty is that many, often by far the larger part of the mass, are made up of pebbles which have gotten their shape without actual attrition, being simply rounded by chemical action, or keep their original form; but, in any case where many pebbles with a faceted character occur in a conglomerate it may be safely concluded that it has been formed by ice action.

Pebbles having the above described characters occur in abundance throughout the unaltered part of the conglomerate which underlies the Rhode Island coal. This with the other features may be taken making it pretty nearly certain that it had a glacial origin. It must be noticed, however, that in no case have the

pebbles, which have been observed, retained their scratches. In view of the fact that the larger part of our drift beds do exhibit this characteristic in some of their pebbles it must be allowed that this seems a serious difficulty in the way of the hypothesis that the conglomerate pebbles were formed by glacial agency. It is to be noticed, however, that all these conglomerates show the effects of water action in the rearrangement of the fragments and can only be compared with that part of our drift along our shores which has been rearranged in a similar manner. We find on examination that all those beds of drift pebbles which come within the submergence left on our shores have lost the traces of ice action which they generally bear on their surfaces; the facet-like faces are retained, but the scratches are, in all the instances which I have examined, quite worn away. Moreover, the boulders of this ancient period have undergone so much pressure even in those cases where there has been no great mineralogical change, that in almost all the localities which I have examined, distinct marks of change in form are quite evident. Such changes would necessarily have been accompanied by obliterations of such fine exterior markings as glacial scratches. Taking the assemblage of characters observable in this conglomerate, I am inclined to think that it was formed in great part beneath the level of the water, the pebbles and cement being transported by glacial agency and deposited in the ancient sea just as they are now being carried and deposited by the glacial streams on the Greenland coast.

The connection between the carboniferous period and a preceding epoch favoring the deposition of extensive beds of conglomerate is a fact well established both in this country and Europe. The conglomerate and grits which underlie the coal are generally made up of materials which appear to have been transported for considerable distances. This detrital epoch which is so generally indicated by the subcarboniferous formations can best be accounted for by supposing that the forest period of the carboniferous age was preceded by a glacial period of great duration and intensity. During this ice time and immediately succeeding it there would have been, along the shallow border waters of the old continents, great accumulations of pebble beds and sandstones, which would show throughout the stratifying action of water. During the period of reëlevation, which would have followed an ice time then, as it followed the ice time which has just passed away, these beds

of stratified drift would have become covered with a luxuriant vegetation which was in time to be converted into the beds of coal in which its remains have been entombed. The present geological period is a carboniferous period, and in time its coal beds will be found resting upon just such a section as now characterizes the rocks of the ancient coal time. The Dismal Swamp, when it is converted into coal, as it well may be in the future, will show a drift section beneath it where the conglomerates will be composed of pebbles which owe much of their transportation to ice action, though their final arrangement is the work of water. It may be asked why do we not have the unstratified drift and the scratched pebbles of the glacial period which preceded the carboniferous epoch; the answer is easy to find, the shore regions of any continent when the successive submergences keep up the process of deposition, are the only parts of its surface where we can expect to find a record of ancient conditions long before anything like the time has elapsed which has rolled away since the carboniferous period, or the unstratified drift of our shores may have disappeared, leaving only such imperfect record as may be perceived in the bedded conglomerate which may happen to be buried beneath succeeding deposits. The conjunction of conglomerates and coal beds is not limited to the carboniferous period. I am unacquainted with the history of the jurassic and cretaceous coals which occur at various points, but in the tertiary period we see at least twice the same swift change from the desolation of glacial conditions to luxuriant vegetation, which is shown in the period in which we now live, and which I have suspected in the carboniferous time.

The cause of these sudden transitions in climatic conditions is yet to be explained. Apart from the question of the origin of the glacial periods of the past which cannot be discussed here, it is easy to see that the glacial period which has just passed away has done much to favor the development of a luxuriant vegetation over a large part of the country it affected. In the first place the ice work of the glacial time was effective in producing a large amount of well ground material. The surfaces it covered were probably reduced to a state fit for assimilation by plants at a very much more rapid rate than would else have taken place in the same regions under the existing conditions; it must also be noted that the supply of nutriment from the rocks is very much more rapid on a soil filled with glacial material than in one where the action

is by atmospheric erosion alone; every pebble in a gravelly soil wastes over its whole surfaces, so that the aggregate area of supply whence plants can draw their nutriment is many times greater than if it all came from the wearing of the bed rock. There is also the mingling of materials which took place during the glacial period, which has not been without effect in increasing the productiveness of soils. This action has brought into each cubic foot of our boulder clays a great assortment of diverse materials giving a soil ready for the nutrition of any seeds which fall upon it. However varied the demand, it would be sure to find the materials at hand. During the glacial period there was no vegetation in the drift covered region for a period of time which must be reckoned by thousands if not hundreds of thousands of years, so that the materials which came into an assimilable condition remained unappropriated by plants and were in a fashion stored for their future use; when the ice sheet passed away, the soil was left with a rich store of materials suitable for the nutrition of plants. It may be that the vigor of the carboniferous vegetation was in part the result of this glacial preparation of the earth's surface for vegetable life.

The whole time of the formation of this conglomerate was a period of recurring changes of condition. The pebble beds alternate with sandstones and shales and occasionally with somewhat carbonaceous layers of slate. At one point, Wood's Castle, on the eastern shore of the island, the conglomerate is immediately overlaid by carbonaceous shale with faint traces of coal plants; above the coal comes a greenish shale of an unknown thickness. It may be said by some that the juxtaposition of carbonaceous beds makes the glacial origin of the conglomerate doubtful. That this reasoning would be fallacious is well shown by the fact that in New Zealand we have a vegetation more closely allied to that of the carboniferous period than is found in almost any other region growing in the immediate neighborhood of the glaciers. Very slight changes in the conditions prevailing there might bring a vegetation of palms and tree forms upon the débris of the ice streams.

The history of these conglomerates would not be complete without a consideration of the often noticed and much misunderstood compression of the pebbles. The pebbles which make up a large part of the conglomerate which lies to the south of Easton's Beach

and that which is found in the neighborhood of Taunton are usually so nearly in the condition in which it was originally formed that even the accustomed eye fails readily to detect any change in its structure, from compression. At other points to the northward the distortion of the elements which compose the conglomerate is very great indeed. The inquiry into the history of this great change must be made in connection with our study of the dynamic history of the beds of the island.

REVIEWS AND BOOK NOTICES.

THE EVOLUTION OF LIFE.* — An exceedingly interesting and suggestive book, as it is so full of the spirit of Hæckel's writings, of which it is in large part a condensation. We doubt not that it will be extensively read by those interested in natural history studies, though more especially designed to place before the general reader "a condensed view of the evidences for the theory that the animal and vegetal worlds have been very gradually developed or evolved, as distinguished from the hypothesis of their sudden special creation." For the purpose of popular exposition the author's style is excellent, being simple and concise. As we suggested, the work is a reflection of Hæckel's "History of Creation," a remarkable book by a remarkable man. The successor of Oken at Jena, he partakes largely of his spirit, and with much that is strikingly original and suggestive in his popular works, there are portions that are highly exaggerated, facts being sometimes strangely twisted to suit his theory. Hæckel's guesses and assumed intermediate types may be in many cases proved true years hence, but the history of evolution cannot be written by one man in a single century. The "Evolution of Life" must be judged by the same canons of criticism. The impression made on our mind after examining it is, that the author is far more sure of his deductions and grouping of facts than would be a specialist in any one of the classes of animals, whose supposed genealogy he indicates in some cases, at least, with a degree of overconfi-

* Evolution of Life. By H. C. Chapman, M.D. Philadelphia, J. B. Lippincott & Co. 1873 (received Oct. 9, 1872). 8vo. pp. 193. With diagrams and plates. $4.00.

dence. In a word, we doubt whether the candid, cautious zoological expert, though a believer in evolution, would accept many of the apparent conclusions of this taking book. For instance, the homologies of the sponges with the polypes are accepted to their fullest extent by the author, so of the holothurians with the worms, and more especially the supposed passage of the ascidians into the vertebrates. A few explanatory words bridge over the intervals between these grand divisions of animals as if the matter had passed discussion.

In all candor we should say after a second reading of the chapter on Echinodermata, that it is a fair specimen of zoology run mad; but for that matter, though agreeing with the general evolutional views of the author, the errors to which we refer are to be found in the parent of the present work, Hæckel's brilliant and remarkable but faulty "History of Creation," a true child by intellectual descent of Oken's "Physiophilosophy."

We proceed to some special criticisms. Is the animal figured so rudely (many of the figures are exceedingly poor) and described on p. 37 really a Sipunculus? Both the figure and description remind us rather of Synapta. The author on p. 40 adopts Hæckel's strange and misleading view as to the organization of the starfish, in the following language. "The arm of a starfish is, in fact, a worm; not simply resembling one but structurally the same, the segmentation, the water vascular system, the nervous cord in each arm of the starfish being exactly the same as that of an articulated worm [!!]. The starfish has probably been produced through the union of five worms, the worms having united at their posterior ends, since the eyes are seen at the free ends of the starfish [!!!]." This we also find in Hæckel's "History of Creation," though Hæckel figures the embryo of the starfish. Thanks, however, to the labors of Johannes Müller, Professor and Mr. A. Agassiz, and Wyville Thompson, we have such accurate information as falsifies this singular conception. Farther on, Dr. Chapman concludes, and this is a specimen of his over-confident, uncritical mode of dealing with these subjects, that "The origin of the Asteridæ, or starfishes, from the worms is in perfect harmony with the structure, development and petrified remains of the group. The most striking facts of their economy are explainable on such a theory, but are perfectly meaningless on any other." No one whose conception was not founded on mere second-hand

book knowledge could write like this. We would inquire whether what we know of the embryology of the Comatula from the researches of Wyville Thompson does not point to the evolution of the Crinoids from the lower Radiates, the Acalephs, and further on from the Hydra? From the researches of Müller, Professor Agassiz and Mr. A. Agassiz, the embryos of the three classes seem readily homologized, and the forms of the embryo of the starfish which so strikingly resembles some worms, such as Sipunculus, Balanoglossus and Nemertes for example, are perhaps the result of similar modes of life, and not of genetic significance; farther than that they possibly indicate a protozoan origin. Again, the inadequacy of the author's knowledge of the invertebrates is conspicuous in the statement on page 44 that the "centipedes, insects and spiders are joined in one division, Tracheata," when any text book would have told him that the spiders do not have tracheæ. While, as he says, the Myriopods are composed of numerous segments, "in the insect we can distinguish only three segments known as head, thorax and abdomen." . . . . "So in the Arachnida we find only two segments [!!]." A moment's glance at a specimen would have saved such a sad blunder. The matter is scarcely mended by the statement on the next page that "the numerous segments of which the immature insect and spider are composed gradually coalesce, until finally the perfect insect exhibits only three pieces, the spider two."

Though the portion on the invertebrates is often weak and faulty, the remaining chapters seem to be more carefully prepared, though the tone of the book, like Hæckel's, is that of an advocate, the adverse facts being kept in the background. Read with due caution, the book is a fair résumé of the opinions of many able naturalists as to the probable mode of development of man and the lower organisms.

Illustrations of North American Moths.*—This is a valuable work and worthy of all encouragement, as it gives systematic descriptions (compiled when the author has not had specimens) of the North American (north of the Mexican boundary) species of two extensive and most interesting groups of moths. It offers good

* Illustrations of the Zygænidæ and Bombycidæ of North America. By R. H. Stretch. Vol. 1, parts 1-5. San Francisco, 1872. 8vo. Each part 32 pages. Price, uncolored, 75 cents a number; colored, $1.00. Send subscriptions to author, or the Naturalists' Agency.

figures of species (with cuts showing the venation of many genera), for the most part never before illustrated, or those only figured in costly works. The "Illustrations" will probably extend to about 30 parts, each containing one or more colored plates. Many new Californian species, some of striking interest, are already figured, with good descriptions both of the adult and the larva. Among the most important are three new species of Alypia from California; four species of a beautiful new genus, Kodiosoma, said to be allied to Phragmatobia, the larva of which is said by Dr. Behr to bear "a striking resemblance to that of Syntomis and the cocoon to that of Halesidota; several new species of that elegant genus Arctia, two remarkable species of Sthenopis, a new form allied to *Hemileuca Maia*, and a new Gastropacha, and Notodonta.

The author shows quite conclusively that *Epicallia guttata* is but a variety of *E. virginalis*, as the larvæ of the two forms do not vary.

We also have a description of the larva of *Arachnis picta*, with an interesting account of its habits. The account of the singular genus Phryganidia, regarded as a Psycid by the reviewer, is considered by Mr. Stretch as probably a Zygænid, as "the transformations of *P. Californica*, on which this genus is founded, is so dissimilar to those of the true Psychiinæ, that I remove the genus to its present position though with some hesitation, and chiefly because I feel unable to assign it a more satisfactory position. Not only does the larva, which has some resemblance to Eudryas construct no 'sac,' but it does not even construct a cocoon of any kind, and the pupa is naked and suspended by the tail." We had compared this form with the European genus Heterogynis, but the author remarks that the latter is removed by many European writers to the Zygænidæ. As the larvæ are abundant, sometimes stripping live oaks of their foliage, we hope to receive specimens of the insect in all its stages and study it anew. The larva of *Halesidota Agassizii* is described for the first time, and that of *Drepana siculifer* noticed briefly.

As to the specific distinctness of *Eupupia Americana and E. caja*, we are now inclined to regard the two forms as climatal varieties of a single circumpolar species which runs down both sides of the American continent and on the European side of the eastern hemisphere.

As we are writing this notice, Part V comes to hand, with an excellent plate on which are figured three species (one new) of

Leptarctia, an interesting new genus, of the transformations of which we shall eagerly await information.

We hail with pleasure the appearance of this first work on Californian insects by a native entomologist, and wish it every success.

FOURTH REPORT OF THE PEABODY ACADEMY OF SCIENCE.*—This report is mostly occupied with original papers in natural history, representing the work done in the museum or upon specimens contained in its collections. In his paper entitled "Synopsis of the Family Heteropygii," Mr. Putnam gives a detailed account of this interesting family, represented by the Blindfish of Mammoth Cave, and its allies found in certain subterranean streams and wells and rice ditches of the Southern states, of which a popular account has been given in this journal.

The paper by Mr. Scudder, entitled "A Systematic Revision of some of the American Butterflies: with brief notes on those known to occur in Essex County, Mass.," will afford food for thought to entomologists, and will interest European as well as American naturalists. This important essay "gives a digest of the results reached by a critical examination of the structural features of many American butterflies—principally those of New England. The earlier stages of these insects, as well as the perfect forms have been subjected to careful study." Some sweeping changes have been made by the author both in the classification and synonymy of this important group, based on more thorough study, we venture to say, than has ever before been given to the group. We deem this paper one of the most important contributions to entomology that has appeared for several years.

In the succeeding short papers by Dr. Packard are descriptions of a few new moths from New Mexico and California, and a "List of the Coleoptera collected in Labrador," the specimens having been identified by Dr. Horn.

Appended to the report is the "Record of Entomology for the year 1871." From it we learn that thirty native entomologists have contributed entomological notes and papers during that year. This record is invaluable to entomologists, as showing what work has been done both in America and Europe on our native species.

* Fourth Annual Report of the Trustees of the Peabody Academy of Science, for the year 1871. Salem, 1872. 8vo, pp. 117. Price 75 cents.

We trust that entomologists will aid in supporting this enterprise, and send the small pittance of 50 cents asked for a separate copy.

Birds of Kansas.*—The first edition of Professor Snow's "Catalogue of the Birds of Kansas" has already been noticed in these pages,† and some of its shortcomings briefly mentioned. We have now the second edition of this work, in which the deficiencies of the first are fully supplied. The number of species has been raised from 239 to 282, and many typographical and other errors amended. Few species probably now remain to be added except such as are accidental or casual visitors. We notice that *Centrocercus urophasianus* has been stricken out, and that among the many important additions are *Garzetta candidissima*, *Herodias egretta*, and *Graculus Mexicanus*, not previously reported from Kansas. The latter (*Graculus Mexicanus*) we are informed was identified by Professor Baird, and forms the first known instance of its occurrence north of the Rio Grande. The nomenclature is that of the ninth volume of the Pacific Railroad Reports, and hence a number of species are admitted that are not now usually regarded as valid. In addition to Prof. Snow's own observations, he has availed himself of all the aid within his reach, and has thus given us a highly valuable and creditable list of the birds of Kansas. It forms a neatly printed pamphlet of 16 pages, and has a less number of typographical errors than similar brochures usually have, though we find "*Erenentes*" printed for *Ereunetes*, "*Passarella*" for *Passerella*, etc.—J. A. A.

BOTANY.

Fertilization of Yucca by a Moth.—At the Dubuque meeting of the American Association for the Advancement of Science, Prof. Riley gave an abstract of a paper which will appear in full in the Transactions of the St. Louis Academy of Science. He briefly described the generic and specific characters of a little moth which is one of the most anomalous known to entomologists. He first described how many of our flowers, such as the Asclepias and orchids, were curiously constructed so as to be incapable of

* Catalogue of the Birds of Kansas, contributed to the Kansas Academy of Sciences. By Frank H. Snow, Professor of Natural History and Meteorology in the University of Kansas, at Lawrence. Second edition, Oct., 1872. 8vo. 16 pp. 25 cents.

† Amer. Nat., vol. vi, pp. 359, 482, 483.

fertilizing themselves, and at the same time to attract insects to do it for them. Dr. Engelmann had this year discovered that Yucca was one of those plants which depended on insects for fructification, and Prof. Riley had discovered that the little moth in question, which he calls *Pronuba yuccasella*, is the only insect which can have anything to do with this fructification. But what is more interesting in this case is, that the plant not only depends on the assistance of the moth, but that the moth, in turn, is likewise dependent upon the plant, since its larvæ live on the seeds. We have, consequently, a mutual interdependence which is very striking, and in the structure of the female moth there is a curious adaptation of means to an end by a complete modification of parts, and especially of the maxillary palpi, which are formed into prehensile tentacles, by which she collects the pollen to insert it into the stigmatic tube.

Trees and Rain.— The influence of trees upon rains and the general moisture of the atmosphere, which has been so much discussed of late, receives a strong illustration from the island of Santa Cruz, W. I.

A friend who spent the months of February, March and April last upon the island informs me that when he was there twenty years ago, it was a garden of freshness, beauty and fertility. Woods covered the hills, trees were everywhere abundant and rains were profuse and frequent. The memory of its loveliness called him there at the beginning of the present year when, to his astonishment, he found about one-third of the island, which is about twenty-five miles long, an utter desert. The forests and trees generally had been cut away, rainfalls had ceased and a process of desiccation beginning at one end of the island had advanced gradually and irresistibly upon the island, until for seven miles it is dried and desolate as the sea-shore. Houses and beautiful plantations have been abandoned, and the people watch the advance of desolation, unable to arrest it, but knowing almost to a certainty, the time when their own habitations, their gardens and fresh fields will become a part of the waste; the whole island seems doomed to become a desert.

The inhabitants believe, and my friend confirms their opinion, that this sad result is due to the destruction of the trees upon the island some years ago.— J. S. M.

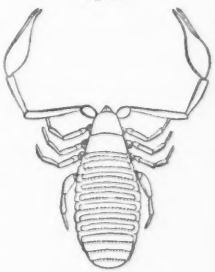
ACER NIGRUM WITH STIPULES.—Mr. J. F. Mills sends a branch of a black maple in which *well-formed foliaceous stipules* are developed, their bases adnate to the petiole. The peculiarity is confined to a single tree, and the like has not been seen before in maples, so far as we know. Mr. Mills should inform us if the peculiarity is reproduced next year.—A. G.

A SEAWEED NEW TO OUR COAST.—This alga (*Hildenbrandia rosea* Kunze) occurs at Mt. Desert, in rocks between low and high water, in similar situations in Massachusetts Bay (Weymouth, Fall River and at Nantucket), and probably all along the coast. —H. WILLEY, *New Bedford.*

ZOOLOGY.

EMBRYOLOGY OF CHELIFER AND PHALANGIUM.—Prof. Metschnikoff, the Russian embryologist, has lately published in Siebold and Kölliker's Zeitschrift, an account of the embryology of Chelifer, of which our *C. cancroides* (Fig. 151) is an example. He remarks in closing "that in view of the great morphological and anatomical similarity between Chelifer and the scorpions we might expect that these animals would be alike in their embryological development. But observation shows that the mode of development of Chelifer reminds us much more of that of the lower Arachnids, namely, the Pycnogonids.* The first embryological occurrence, the segmentation of the yolk, is total in Chelifer, as in the Pycnogonids, Pentastoma and Tardigrades, while the eggs of the true scorpions undergo a kind of partial segmentation. The most peculiar phase in the development of Chelifer, namely, the formation of the larva and its metamorphosis, is at all events much more like the development of the Pycnogonids than the scorpions. I

Fig. 151.



C. cancroides.

* These creatures are considered as Crustacea by perhaps the majority of zoologists. Dr. Dohrn concludes from a study of their embryology that "The Pycnogonidæ are neither Arachnida nor Crustacea; with the former they really have no relationship, with the latter they have, as a common starting point, the nauplius form, but they depart at this point from the course of development of the Crustacea, which continues to go on to the zoëa form.

now refer to the larvæ of Pycnogonum and Achelia described by Dohrn, and especially to the presence of the yolk within the maxillæ of the larva of Chelifer, which circumstance connects it with the embryology of Phoxichilidium.

"It is remarkable that the larva* of Chelifer stands still lower in its grade of development than the nauplius larvæ of Crustacea and the larvæ of the above mentioned Pycnogonids. It indeed presents a nauplius form with only two pairs of extremities, but in all cases the second pair is completely developed (in the form of forked swimming feet) while the same only appears in the youngest larva of Chelifer as a stump-like form.

"In closing I will remark that in its developmental relations Chelifer differs much more from the Araneina (spiders) and scorpions than Phalangium, the Phrynidæ, and even the Acarina.

"The writings of Gerstaecker, Claparède and Zalensky, on the two last mentioned groups, show us that their embryology agrees in many points with that of the Araneina. I can say the same from the development of *Phalangium opilio* observed by me. The embryo of this animal resembles in its general features the well known embryos of spiders, and differs especially through the want of a (provisional) postabdomen, and the relatively less development of the abdomen."

The last number of the "Annales des Sciences" has just come to hand containing Balbiani's memoir "sur la developpement des Phalangides." The eggs and embryo just before hatching were so much like those of spiders, that he mistook them for such. The earlier stages such as Metschnikoff alludes to he does not seem to have noticed.

Embryology of the Myriopods.—The only studies on this subject of any special value, previous to the researches of Metschnikoff, are those of Newport on the development of Julus; but these do not relate to the earliest changes in the egg.

In a note to the paper noticed above, Metschnikoff states that he has observed a new instance of the total segmentation of the yolk in the egg of *Polyxenus lagurus* and he believes that this phenomenon is more widely distributed in the insects and crustacea than we suppose. "After the total segmentation of the

*The embryo is here referred to, as the term larva should be restricted to the animal after leaving the egg.—Eds.

yolk, transparent cells separate from the lower pole of the egg, which indicate the germ. In this soon appears a transverse impression whereby the germ becomes divided into two great divisions. Somewhat later the rudiments of six pairs of extremities bud out, of which the first pair, the antennæ, may be recognized by their larger size. The embryo presents in this stage a great similarity to the embryo of Gammarus, especially since the primitive streak arising from the germ is bent bow-like on the ventral surface. An amnion is formed in Polyxenus, also a serous membrane; only a few amœboid cells separate from the germ, which have the greatest resemblance to the egg-amœbæ observed in the Acarina by Claparède and Zalensky, and by me in an Araneid. The germ and embryo of Polyxenus originate from two layers, which correspond to the first two germ membranes of the scorpions and other articulates."

THE KINGBIRD OR BEE MARTIN.—In the rural life of American boys it is always with pleasure that the frequent scene is beheld of the kingbird (*Tyrannus Carolinensis* Baird) attacking the crow; oftentimes we have seen this plucky little creature pursue this great fellow, and alighting on its back "peg into" the great lubber, making it squeak in pain and terror, to our juvenile delight. This sort of persecution every crow must expect that unwittingly passes within a few yards of a kingbird's nest; and so inveterate is the antipathy of these little tyrants, that frequently I have seen three of them pursuing a luckless crow, who was winging a retreat at the highest rate of speed he could command. I have come to the conclusion that Tyrannus is not a kingly bird, but just as mean, and capable of as small dealings as some other folks. In fact, his sallies after the crow are for the most part actuated by a spirit of persecution, and in no sense is he a knight-errant in pursuit of some dark giant oppression. He is a mean, quarrelsome, contentious, selfish, unprincipled little fellow, and my admiration of him has gone plump down to zero. I had occasion a few days ago to visit my friend Captain Swan of Forked River, Ocean County, New Jersey. Opposite his house is a pleasant little grove with croquet ground, etc. The trees are bountifully supplied with bird houses, and the birds find in the captain a protector. He showed me a nest in the crotch of a maple tree, and said that he and his family had watched with great interest a pair

of robins build it. All the time of nidification eagerly watching the progress was a pair of kingbirds. Just as soon as the nest was completed these royal tyrants took possession. Of course there was a determined remonstrance from Mr. and Mrs. *Turdus migratorius*, who had no notion of being thus summarily ousted from a home which with hard labor they themselves had just built. But this king and queen Tyrannus conclusively settled the dispute by showing that might makes right, and Mr. and Mrs. Robin withdrew, as the only way to save their bacon. Having thus "jumped the claim," the kingbirds took possession, and raised a brood of young in peace. One of the young ladies felt her sense of justice so outraged that she wanted to rout the invaders with a broom; but the captain interfered, and they were undisturbed. The very noticeable fact is that these ornithic scamps kept prying around, watching with genuine royal indolence the progress of the labors of the busy unsuspecting builders; then when all was finished, with true kingly impudence they took possession as of royal right.—SAMUEL LOCKWOOD.

ARACHNACTIS THE YOUNG OF EDWARDSIA.—The genus Arachnactis established by Sars for a small floating Actinia has been studied by Busch and myself who came to the conclusion that it probably was the pelagic stage of an Actinoid allied to Cerianthus. During the last summer I have succeeded in raising from young Arachnactis (like those described and figured by me in the Proceedings of the Boston Society of Natural History) somewhat older stages, and to keep them alive till they lost their pelagic habits, and remained more or less stationary on the bottom, creeping slowly along by means of their tentacles on the elongated column.

The changes observed in the older stages of Arachnactis consist of the gradual resorption of the embryonic cells at the posterior extremity of the column, the increase of the number of tentacles, taking place in pairs at one extremity of the longitudinal axis of the disk, the elongation of the column, the increase in size of the ovaries, the differentiation of the column into an anterior part where the partitions are situated, becoming externally more and more corrugated transversally with advancing age, this anterior part being comparatively capable of but slight expansion and contraction, and a posterior part of the column capable of great expansion and contraction, especially at the very extremity of the

column. In fact the Arachnactis has now become a diminutive Edwardsia, with eight partitions from which are suspended ovaries of different lengths, as we find them in Edwardsia.*— A. AGASSIZ.

SWAMP RABBIT (*Lepus Aquaticus*).—This is a widely distributed species. It abounds in the canebrakes of Alabama, Mississippi, Louisiana, Arkansas and Texas. It is found in the portion of country I have named, on all the watercourses, even on the little branches, rarely on uplands. Its flesh is considered the best, most digestible and most nutritious of all the small game. In sugar-cane countries it subsists principally on the leaves of the cane. To procure the leaves of the tall cane, the rabbits will stand on their hind feet and cut the cane in two about fifteen inches from the ground. Being surrounded on all sides with other canes, the stalk cannot fall, but dropping straight down by the side of the stump it remains standing, when the rabbit stands up again and cuts it off as in the first instance, when it drops a second time, and so on, the animal continues to cut off fifteen inch sections until the top of the cane with its leaves comes down low enough to allow the rabbit to feed on it. Many of these little piles of cut up cane are seen in the cany bottoms of the rivers and creeks of Mississippi. Here in Texas where there is no cane, it feeds on various grasses and some of the wild herbage. Like the old field rabbit, when chased by dogs it seeks refuge in hollow trees, holes in the ground, etc. When it is captured it squeals fearfully and its heart beats audibly. —GIDEON LINCECUM, *Long Point, Texas.— Communicated by the Smithsonian Institution.*

THE SALT LAKE CRUSTACEAN.— A peculiarity of the little crustacean (*Artemia fertilis* Verrill), living in the waters of Salt Lake, which ought to be noticed is that of its congregating in masses of strange appearance in the water. When the masses are small they sometimes stretch out so as to have the form of a serpent. At other times they represent rings, globes and various irregular figures. A gentle breeze does not affect the water filled by Artemia, so that while the water on all sides of these dense congregations is slightly ruffled, that which they occupy remains as if covered by oil, thus indicating the figure of the mass. My atten-

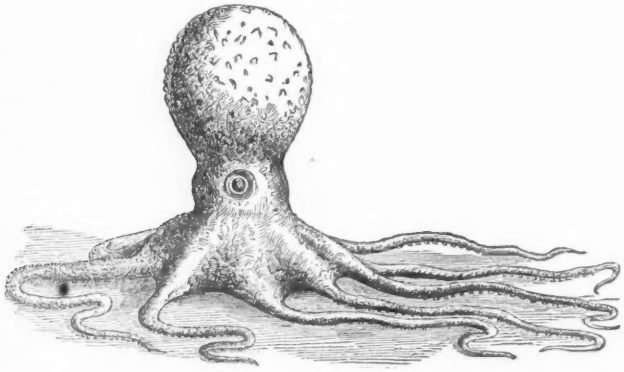
* Though this point has not been mentioned before, nor the irregular number of tentacles varying from eighteen to thirty-two in large specimens of Edwardsia, showing that the development of the tentacles has nothing in common with the cyclical development of the tentacles of Madreporarians.

tion was called to them by seeing on the surface the figure of a great serpent in one place, and in another what appeared to be a small stream of comparatively still water flowing out through the lake.

Though I waded out to, and through, these immense bodies, I could not positively ascertain that the individuals were travelling in a common direction; the time was too short to determine this, yet I think it is the fact.—S. W. Garman.

A colossal Octopus.—A letter just received from Mr. J. S. George of Nassau, N. P., Bahamas, mentions a huge Octopus ten feet long, each arm measuring five feet; the weight was estimated at between two hundred and three hundred pounds. The monster was found dead upon the beach, and bore marks of injury.

Fig. 152.



Mr. George adds "this is the first specimen I have seen during twenty-seven years residence in Bahamas, but they are known here traditionally of immense size."—B. G. Wilder.

[We add a figure (152) of a Brazilian species of Octopus. —Eds.]

Texas Field Mouse (*Reithrodon Carolinensis?*).—This is a very small mouse, found in the cornfields. They are not very abundant. They dig little holes in the ground, under the side of a rock or tuft of grass, where they breed their young in exceedingly soft beds made of finely shred grass. It is occasionally found, where a

hill of corn has been broken down, that these small creatures have entered the shuck, shelled off the grains, cut out the heart very neatly, leaving the corn in a little heap at one side, looking almost as if it had not been touched. Where corn has been planted alongside of a meadow, their sign is more frequently met with, but never to an extent to cause the farmer to feel any uneasiness on the subject.—Gideon Lincecum, *Texas.—Communicated by the Smithsonian Institution.*

Marine Crustacea in Lake Michigan. Correction. — I desire to correct an unfortunate error in an article on the Mammoth Cave and its inhabitants (vol. v, p. 752, lines 6, 7), and in the separately printed little work "Life in the Mammoth Cave." I there state that a species representing *Idotea entomon*, found living in the Swedish lakes, had been detected by Dr. Stimpson at the bottom of Lake Michigan. In fact no crustacean of the family to which Idotea belongs is known to exist in our Great Lakes, nor did Dr. Stimpson mention this genus.—A. S. Packard, Jr.

Albino Deer.— A few days since Henry Wilson of Cape Grove, a short distance from here, killed an albino deer. The head, neck and tail were pure white, while the upper portions of the body and back were so nearly white that you could hardly see the spots. The animal was a fawn of our common Virginia deer, and about three months old. Its eyes were also white.— Chas. H. Nauman, *Titusiria P. O., Volusia Co., Fla.*

GEOLOGY.

The Proboscidians of the American Eocene.—During the past summer, Prof. Cope, in charge of a division of Dr. F. V. Hayden's Geological Survey of the territories, explored the palæontology of the Eocene beds of Wyoming Territory. He obtained many species of plants, mollusks and insects, and eighty species of Vertebrata, of which some fifty are new to science.

One of the most important of the discoveries made was the determination of the type of proboscidians prevalent in that period. This is exceedingly peculiar and anomalous in many respects. Proboscidian limbs are associated with a dentition of the same type, when the number and position of the teeth are considered. Thus a huge external incisor only occupies the front

of the upper jaw (premaxillary bone); there is no canine, and the molars are few. The incisor is shorter than in the mastodons, etc., and is compressed, trenchant, and recurved, forming a most formidable weapon. The great peculiarity is seen in the structure of the molars, which is nearly that of *Bathmodon* Cope, an allied Perissodactyl. This type is, however, graded into an approach to Dinotherium in another Perissodactyl, *Metalophodon* Cope, of which more below.

The type species of this group, called by Prof. Cope *Eobasileus cornutus*, is as large as the Indian elephant, but stood lower, having proportions more like the rhinoceros. The elongate form of the cranium added to this resemblance. The physiognomy was very peculiar. On either side of the front, above each orbit, rose a stout horn, its base continuous with that of its mate. The immensely prolonged nasal bones overhung the premaxillary, as in the rhinoceros, and supported on each side near the extremity a massive reverted shovel-shaped protuberance, which united at an open angle with its fellow on the middle line in front.

These beasts must have lived in herds, like the elephant of to-day, judging from the abundance of their remains, no less than twenty-five or thirty individuals having left their bones within a short distance of one of the camps of the party. Three species were distinguished: *E. cornutus*, *E. furca'us*, and *E. pressicornis*.

The resemblance of the tusks to canine teeth is such as to have induced a late author to have based the description of a supposed carnivore of large proportions on one of them.

The Armed Metalophodon.—This is an extinct odd-toed ungulate discovered by Prof. Cope in the lowest or "Green River" division of the Eocene of Wyoming. The only species found was named *M. armatus*. It possessed a full series of six superior incisors, and had a formidable knife-like canine, with cutting edges and a groove on the outer face. The premolars are like those of Bathmodon, *i. e.*, with one outer crescent, while the molars differ in having the constituent crest of the single crescent separated on the inner side of the tooth, thus producing two subparallel crests. The lower premolars are singular in possessing one crescent, with a rudimental second by its side. This increases in proportions on the posterior teeth till on the last inferior molar the two are nearly equally developed. Alternate ridges are however on this tooth

reduced and rudimental, leaving a parallel two-crested tooth, approaching a Tapia or Dinotherium. There were probably tusks in the lower jaw.

The animal was about the size of the rhinoceros and constituted another addition to the well-armed ungulates of the Wyoming Eocene. The transitional forms seen in its tooth structure constitute a point of especial interest.

The Fish-beds of Osino, Nevada. — Investigations into the geology of Nevada, conducted during the present season by Prof. Cope, of Dr. Hayden's Geological Survey, have resulted in the discovery of an extensive lake basin, which was filled with fresh water during some of the Tertiary periods. Its deposits were thrown into lines of upheaval by the elevation of the Ruby Mountain Range, and the North Humboldt River traverses the deepest portion of the old lake. The Humboldt River Sink is its last remnant, bearing the same relation to the Humboldt River as the Great Salt Lake to the Bear River of Utah.

The strata are in many places exceedingly thin and paper-like, resembling the braun kohle of Prussia. Two seams of a cannel-like coal, of about three feet each in thickness, have been exposed by excavations. This is the most western locality for coal east of the Sierra Nevada. The shales contain great numbers of fossil fishes, insects, plants, etc. The fishes are all of fresh water types; one of them is related to the existing type of *Catostomidæ* (sucker), and has been called *Amyzon mentale*. It is a sucker with the sucking mouth "left out;" that part resembling its prototype in ordinary fishes. Another species is related to the "Bull-minnows" (*Cyprinodontidæ*), but differs from known genera in having bristle-like bodies instead of ordinary scales. It is called *Trichophanes hians*. The insects are chiefly mosquitoes and long-legged flies (Tipula).

The age of the beds was thought to be Green River or Lower Eocene.

On the northern ridge bordering the Humboldt valley, Nevada, there are completely opalized portions of trunks of trees which were at least five feet in diameter. The ground is strewn with black, yellow, red, purple or porcelain-white colored fragments. The age of the remains is probably Tertiary and the trees are mostly dicotyledons.

ANTHROPOLOGY.

Antiquity of Man in America.—The discoveries that are constantly being made in this country are proving that man existed on this continent as far back in geological time as on the European continent; and it even seems that America, really the old world geologically, will soon prove to be the birthplace of the earliest race of man. One of the late and important discoveries is that by Mr. E. L. Berthoud, which is given in full, with a map, in the Proceedings of the Philadelphia Academy of Sciences for 1872, p. 46. Mr. Berthoud there reports the discovery of ancient fireplaces, rude stone monuments, and implements of stone in great number and variety, in several places along Crow Creek in Colorado, and also on several other rivers in the vicinity. These fireplaces indicate several ancient sites of an unknown race differing entirely from the mound-builders and the present Indians, while the shells and other fossils found with the remains make it quite certain that the deposit in which the ancient sites are found is as old as the Pliocene and perhaps as the Miocene. As the fossil shells found with the relics of man are of estuary forms, and as the sites of the ancient towns are on extended points of land and at the base of the ridges or bluffs, Mr. Berthoud thinks the evidence is strongly in favor of the locations having been near some ancient fresh water lake, whose vestiges the present topography of the region favors.

MICROSCOPY.

Fungous Growth in Shells.—"In a paper read before the Manchester Philosophical Society on the 26th of February, Mr. Mark Stirrup exhibited sections of shells of mollusca, showing so-called fungoid growths. He referred to Dr. Carpenter's report on shell structure, presented to the meeting of the British Association in 1844, in which especial mention is made of a tubular structure in certain shells, Anomia being cited as a characteristic example. In the last edition of 'The Microscope,' Dr. Carpenter he said, withdraws his former explanation of this structure, and now refers it to the parasitic action of a fungus. Mr. Stirrup showed sections of this shell penetrated by tubuli from the outer

to the inner layers of the shell, and it is upon the inner layer that the curious appearances of sporangia, with slightly-branched filamentous processes proceeding from them, present themselves. The parasitic view is strengthened by the fact that these markings are not found in all parts of the shell, and are certainly accidental. Professor Kölliker maintains the fungoid nature of these tubuli in shells as well as in other hard tissues of animals, as fish scales, etc. Mr. Wedl, another investigator, considers the tubuli in *all* bivalves as produced by vegetable parasites, and that no other interpretation can be given. This view does not seem to be borne out by the section of another shell which was exhibited, *Arca navicula*, in which the tubuli are always present forming an integrant part; they are disposed in a straight and tolerably regular manner between the ridges of the shell; moreover, they have neither the irregularly branched structure nor the sporangia." — *Monthly Microscopical Journal.*

Advancing Definition of Objectives. — Tolles has lately made a $\frac{1}{18}$ immersion objective for the United States Army Medical Museum, with which Dr. Woodward has produced photographic prints (of Nobert's bands) that far excel any previous work of the same kind. The transparencies on glass are remarkably clear, and the paper prints give the lines in such a startling appearance of relief that it is difficult, even after feeling of the paper, to realize that the lines and the spaces between them are all printed on the same plane. This lens seems likely to replace the now famous $\frac{1}{16}$ as a standard of comparison, the first appeal and the last, for high-power lenses of great pretensions for oblique-light work. If any maker has made or can make, of which last there is no doubt, a lens that will define Nobert's lines better than this, he will confer a favor by presenting to the world proof of the fact. The following note from Dr. Woodward explains itself.

Resolution of Nobert's Band. — I desire to make public the fact that, since February, 1872, I have received for inspection from Mr. R. B. Tolles of Boston, several objectives ranging from $\frac{1}{10}$ to $\frac{1}{26}$ (maker's nomenclature) which resolved the nineteenth band of the Nobert's plate in my hands. Last month I received from Mr. Tolles an objective made to fill an order of long standing for the Army Medical Museum. The immersion front of this objective (marked $\frac{1}{18}$ by the maker) separates the lines of Nobert's

plate, *from the lowest to the highest band, more satisfactorily than any objective I have hitherto tried.* I must also give its performance on *Amphipleura pellucida* by lamp light the preference over any similar work I have done or witnessed. The price of this objective was one hundred and seventy-five dollars.

I send herewith some glass transparencies from negatives of the nineteenth band, taken by this lens, together with some paper prints of the several groups of the plate.—J. J. Woodward, *Washington, Sept. 3d.*

Photo-mechanical Printing.—In the September number of the Naturalist is an article under this caption, giving some of Dr. Woodward's ideas, and an editorial dissent from them. Now this difference of opinion relates to a point that ought to be settled by the judgment of microscopists, and I write this for the purpose of calling for their views of the question. I quote from the article: "Even the microscopist himself, being unable to represent all that he sees, is obliged to select what he conceives to be of importance, and thus represents his own theories rather than severe facts" (*Dr. Woodward*). The comment is ["If, however, his theories are correct, and his delineation skilful, this very power of selection and construction enables him to give a distinctness and completeness which is lacked by the photographic camera."]

Here are two almost opposite principles of illustration in question. Which should be the governing one? What is the object of the pictures? Obviously there are two; one for explanation of the observer's theories; the other, that other observers may in repeating the observation be guided by and recognize what the first one had seen, and this I consider the all-important object of "figures." If the observer draws only what he thinks important, he must almost invariably make a picture quite different from the one seen in the microscope — he has omitted what he deemed the unimportant parts — and the pupil trying to follow him finds the actual appearance so different that he does not recognize it as the same. No doubt many of the misunderstandings or differences of opinions among microscopists have originated from this very defect of published figures, which have been taken to be what they purported to be, representations of what was actually seen — "if his theories are correct;" but if his theories are wrong then his skilful delineation has only misled

his readers. But if the draughtsman publishes his figure as explicitly as his theory, not as the representation of the "severe fact," then he will be understood.

On the other hand, the camera represents exactly what may be seen by any other observer, *using the same appliances* (which should in all cases be described) and the student can draw his own conclusions from the picture as to the soundness of the theories advocated. But then it must be remembered that a photograph can represent only one view of an object, while the observer by changing the focus of his instrument obtains a new view at each movement of the screw. With the high power lenses now in use, these differing views are all important for correctly understanding almost any object. Therefore scarcely anything can be properly illustrated by one photograph. Many objects must require several. —C. S.

This inflexible limitation of the photographic view to one section or plane of the object, is evidently one of the points referred to in the criticism quoted above, which, without referring to photography as a means of proof of alleged observations, or of submitting observations to investigators for criticism or deduction, only suggested that for communicating well ascertained facts a skilful delineation may contain more information than any available number of photographic representations. A good drawing, as intimated by Dr. Beale, may often supply the place of a long and unread verbal description.

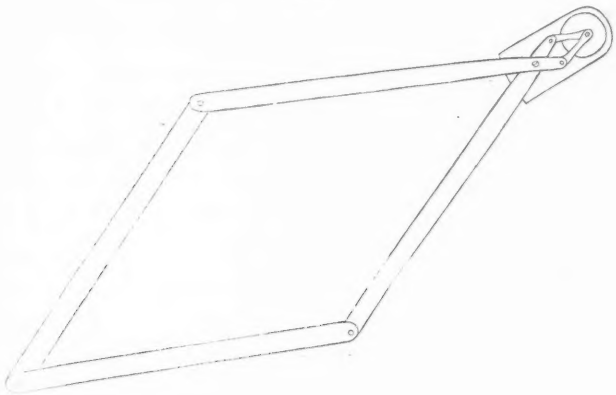
The Submersion Microscope. — Mr. Richards has presented to the Royal Microscopical Society an adjustable submersion tube which can be attached to any objective, thus avoiding the necessity of having a tube specially fitted to each objective which is to be used in this manner.

Dr. Dudgeon's paper in the "Quarterly Journal of Microscopical Science" for July, 1871, seems to claim originality for the idea of a submersion arrangement, but Mr. Richards and others have called it Mr. Stephenson's plan. We hope our London contemporaries will settle this question of priority, and give us the facts immediately. All the submersion arrangements are but slight variations of a single idea, and that for the present we credit to Dr. Dudgeon.

The Micro-pantograph. — Mr. Isaac Roberts publishes in the July number of the "Monthly Microscopical Journal" an illus-

trated description of a most important piece of apparatus. He undertakes to avoid the difficulties of the method of drawing by the camera lucida by substituting an instrument (Fig. 153) which shall present a fixed though large ratio between the movements of the pencil point on the paper and of a given point in the focus of the eye-lens of the ocular. A method previously in use and very easily used, for enlarging or reducing drawings is combined now, for the first time, with the microscope. Two parallelograms of light rods are constructed having their adjacent sides inflexibly connected with each other. All the intersections of the sides are pivoted so as to have a free horizontal motion, and the intersec-

Fig. 153.



tion of the two parallelograms is made a fixed point by screwing it to a brass plate which slides into the ocular in the usual position of a micrometer. The pivot at the outer end of the large parallelogram carries a pencil, and in the corresponding position in the small one is a glass plate with cross-lines ruled upon it. When in use in the microscope the cross-lines are in focus of the eye-lens, and the pencil rests upon a sheet of paper suitably supported near the top of the compound body. The pencil is to be so moved as to cause the intersection of the cross-lines to pass over the parts of the object desired to be delineated. Such a drawing would probably surpass in accuracy any other that could be made.

Mounting Tissues in Balsam. — Portions of thin membranes, or of other tissues, especially when stained with carmine, silver or gold, may be transferred through alcohol to balsam by the following method described by Dr. J. J. Woodward. The preparations are examined in glycerine on a glass slide and under a thin glass cover, and they may be kept in this condition, without further preparation, for several weeks. When one is to be permanently preserved the cover is to be fastened down by a spring clip, and the whole arrangement immersed in seventy-five per cent. alcohol for a few days; after which it is transferred, for the same length of time, to absolute alcohol. The object may then be removed from its position under the cover, and it will be found sufficiently dehydrated to be mounted in balsam in the ordinary way. By this transfer to balsam, permanency is gained and corrugation and distortion are reduced to a minimum.

Mounting Tissues in Dammar Varnish. — Dr. J. W. S. Arnold transfers sections of stained tissues from water to seventy-five per cent. alcohol. After soaking ten or fifteen minutes, the specimen is clarified by oil of cloves and immediately mounted in dammar varnish or balsam dissolved in chloroform. The distortion caused by absolute alcohol is avoided, and the objects are rendered sufficiently transparent.

Logwood Staining Fluid. — Hæmatoxylin is preferred to carmine as a means of staining tissues, by some microscopists. Dr. J. W. S. Arnold prepares the solution by rubbing together in a mortar one part of common logwood extract and three parts (by measure) of pulverized alum, and afterwards gradually adding enough water to dissolve only a part of the powder. The saturated solution thus formed should be of a dark violet color. If too red, more alum must be added. After standing several days it is to be filtered and diluted by one-fourth its bulk of seventy-five per cent. alcohol.

Fungi in Drinking Water. — Prof. James Law found fungi in the blood and in the milk of cows who drank water abounding in diatoms and spores. The health of the cattle was manifestly impaired. Only a part of the cows drinking the water were susceptible to its effect, and they recovered after a change of water and the use of bisulphate of soda. The organisms observed are figured in "The Lens."

Structure of Podura Scales. — Dr. J. W. S. Arnold has succeeded in throwing off, by means of the electric induction spark, some of the "spines" of the familiar test scale of "Podura." Preparatory to this experiment the scales are rendered brittle by drying in an oven. The detached spines are easily beaded by unilateral light.

Dry Rot. — Thomas Taylor, of Washington, D. C., found microscopic fungi upon the leaves of a book which was gradually perishing by dry rot. After treatment by a strong solution of carbolic acid, no further injury occurred.

NOTES.

Captain Scammon announces the speedy publication by subscription of a new work on the "Cetaceans and other Marine Animals of California." The plates are to be full and finely executed. Professor Agassiz commends it as follows.

San Francisco, October 1, 1872.

My Dear Sir: I have been delighted to look over the engravings of the cetaceans and other marine mammals of the West Coast of North America, to illustrate your work upon their natural history, because it is the first time I have seen the whale properly exhibited on paper.

Your practical knowledge of these animals, and the faithfulness of detail and excellence of the representations, will make the work standard; and it will give me the greatest pleasure to do everything in my power to obtain subscribers for you in the Atlantic States and in Europe.

With the deepest interest in your labors, believe me

Very sincerely yours, L. Agassiz.

To Capt. C. M. Scammon, *U. S. Revenue Marine, San Francisco, California.*

We are able to announce that the work will be published by the Naturalists' Agency, and that we are ready to receive subscriptions at this office and shall soon be able to give further information.

We have to record the death, after a short illness, of Andreas S. Oersted, Professor of Botany in the University of Copenhagen, which occurred on September 3d. He was born on June 21st, 1816, and his earlier studies were directed to zoology; in 1841 he obtained the gold medal of the university for a thesis on the Danish Annelids. During the years 1846–48, Oersted travelled in Costa

Rica, and the botanical results of his expedition have appeared in numerous papers in the Transactions of the Copenhagen Natural History Society, and in a series of memoirs on different natural orders, in conjunction with Bentham, Berg, Griesbach, and Planchon. In 1863 was commenced "L'Amérique Centrale" which contains descriptions and figures of new tropical American plants. Oersted's researches in fungi were important, especially his demonstration that Rœstelia is but a dimorphic condition of Podisoma, and his investigations into the organs of reproduction in Agaricus. He was appointed Professor in 1860.—*Journal of Botany.*

A RARE opportunity is offered for those who want a collection of Californian Coleoptera, and insects of other orders. Mr. G. R. Crotch, late assistant librarian at Cambridge University, England, proposes to spend about a year on the Californian coast, going as far south as Guaymas, and then up to Vancouver Island. Mr. Crotch will make a specialty of Coleoptera, which will be named by Dr. Leconte, and made up into sets at ten dollars per one hundred species, two specimens being given whenever practicable. He is willing to collect other orders if wanted.

WE take pleasure in drawing attention to the Essex Institute course of eight lectures entitled "Eight evenings with the Microscope," now in course of delivery in Salem, by Rev. E. C. Bolles. The subjects are "With the Microscope Maker," "In the Laboratory," "In the Garden," "In the Forest," By the Pondside and Seaside," "Among the Insects," "With the Zoologist," "With the Polariscope and Spectroscope." These subjects are most clearly, pleasantly and ably handled by the lecturer. The illustrations enlarged by the microscope and thrown upon a screen twenty-five feet in diameter, by aid of two powerful calcium lanterns, are simply splendid, and we doubt if more finely illustrated lectures for a popular audience have ever before been presented in this or any other country.

A NEW society has been organized in Sacramento, California, under the name of the "Agassiz Institute," with the following officers: — Dr. T. M. Logan, President; F. E. Potter, Recording Secretary; Rev. J. H. C. Bonté, Corresponding Secretary. We are informed that the new society has been formed on the model of the Essex Institute of Salem, and that it owes its birth in great part to the recent visit of Prof. Agassiz, after whom it is named.

BOOKS RECEIVED.

Corals and Coral Islands. By James D. Dana. New York. Dodd and Mead, 1872. 8vo pp. 398. Illustrated with woodcuts, plates and maps.

Man in the Past, Present and Future. A popular account of the Results of recent scientific Research as regards the Origin, Position and Prospects of the Human Race. From the German of Dr. L. Buechner, by W. S. Dallas, London. Philia., J. B. Lippincott. 8vo, pp. 363.

Evolution of Life. By Henry C. Chapman, M.D., Philadelphia. J. B. Lippincott, 1873. 8vo, pp. 195. Illustrated.

Catalogue of Microscopical Preparations in the Cabinet of the Queckett Microscopical Club. 8vo, pp. 39. London, 1872.

Seventh Report of the Queckett Microscopical Club. 8vo, pp. 58. London, 1872.

Intermembral Homologies. By Burt G. Wilder, M.D. 8vo, pp. 88. Boston, 1871.

Fifty-fourth Annual Report of the New York State Library. 8vo, pp. 156. Albany, 1872.

Notes on the Post-pliocene Geology of Canada; with especial reference to the Conditions of Accumulation of the Deposits and the Marine Life of the Period. By J. W. Dawson, LL.D. 8vo, pp. 112. 6 plates. Montreal, 1872.

Tidsskrift for Populære Fremstillinger af Naturvidenskaben. Fjerde binds fjerde hefte. 8vo, pp. 241-324. Kjobenhavn, 1872.

Discovery of Fossil Quadrumana in the Eocene of Wyoming; Note on a new genus of Carnivores from the Tertiary of Wyoming; Notice of a New Reptile from the Cretaceous. p. 1. From the American Journal of Science and Arts, vol. iv, November, 1872. By O. C. Marsh. Published October 8, 1872.

Notice of a new species of Tinoceras. (From the Amer. Jour. Sci. and Arts, Oct., 1872. By O. C. Marsh. p. 1. Published Sept. 21, 1872.

Notice of some Remarkable Fossil Mammals; Notice of a New and Remarkable Fossil Bird. (From the Amer. Jour. Sci. and Arts, vol. iv, Oct., 1872.) By O. C. Marsh. pp. 2. Published September 27, 1872.

Preliminary Description of New Tertiary Reptiles. Part II. (From the Amer. Jour. Sci. and Arts.) By Prof. O. C. Marsh. 8vo, pp. 6. Published Sept. 23, 1872.

Materiaux pour la Faune Belge. Deuxieme Note, Myriapodes. Par Felix Plateau. 8vo, pp. 21, with 2 plates. Bruxelles, 1872.

Qu'est-ce que l'aile d'un insecte? Par Felix Plateau. 8vo, pp. 10, with 1 plate.

Descriptions of New Species of Birds of the Genera Icterus and Synallaxis. By George N. Lawrence. 8vo, pp. 2. (From Ann. Lyc. Nat. Hist., N. Y.)

Twentieth Annual Report of the Regents of the University of the State of New York on the condition of the State Cabinet of Natural History and the Historical and Antiquarian Collection annexed thereto. Revised edition, 1870. Large 8vo, pp. 448, 25 plates. State Document.

Catalogue of the New York State Library, 1872. Subject Index of the Several Libraries. 8vo, pp. 651. State Document.

Fifth Annual Report of the Trustees of the Peabody Museum of American Archæology and Ethnology. 1872. 8vo, pp. 35.

Notes on Chalcidiæ. Parts v, vi, vii. By F. Walker. London, 1872. 3 pamphs., to p. 129. 8vo.

Proces Verbal de la Societe Malacologique de Belgique. April 7-July 21, 1872. 8vo.

Fourth Annual Report of the Trustees of the Peabody Academy of Sciences, for the year 1871. 8vo, pp. 148.

Underground Treasures: How and where to Find Them. A Key for the ready determination of all the useful minerals within the United States. By James Orton. Cloth, 12mo, pp. 137. Illustrated. Hartford: Worthington, Dustin & Co. 1872.

The White Coffee-leaf Miner (Cemiostoma coffeellum Stainton). *A Report as Entomologist to the Government of Brazil.* By B. Pickman Mann. (Reprinted from the American Naturalist.) 8vo, pp. 21, and plate. 1872.

Report of the Geological Survey of the State of New Hampshire, showing its progress during the year 1871. By C. H. Hitchcock. 8vo, pp. 56, and map. State Document.

The Birds of Florida; containing original Descriptions of upwards of 250 species, with notes upon their habits, etc. By C. J. Maynard. Part I. 4to, pp. 32, and 1 colored plate. Salem. Naturalists' Agency. 1872.

Grevillea, a Monthly Record of Cryptogamic Botany. No. 4. October, November, 1872.

Bulletin of the Torrey Botanical Club. Vol. iii. Nos. 9 and 10. September and October.

Geological Magazine. Vol. ix, Nos. 5-7, May, June and July.

Journal of Botany, British and Foreign, for Sept., Oct., Nov., 1872.

Entomologist's Monthly Magazine for Oct., '72.

Revue Scientifique, Paris. Nos. 12-18. Sept. Oct., Nov., 1872.

Journal of the Franklin Institute. Sept., Oct., Nov., 1872.

Quarterly Journal of Microscopical Science for July and October, 1872.

Journal of the Queckett Microscopical Club for July, 1872.

The American Journal of the Medical Sciences. Philadelphia, Oct., 1872.

The Scottish Naturalist. Perth. Vol. I. Nos. 6 and 8. Apr. and Oct., 1872.

American Journal Science and Arts. New Haven. Oct. and Nov., 1872.

The Field. London. Nos. for Sept., Oct., Nov., 1872.

Land and Water. London. Nos. for Sept., Oct., Nov., 1872.

The Academy. London. Nos. for Sept., Oct., Nov., 1872.

Nature. London. Nos. for Sept., Oct., Nov., 1872.

Science Gossip. London. Nos. for Sept., Oct., Nov., 1872.

[Our stock of paper made for the NATURALIST was stored in Boston, and was destroyed in the fire. As it would be several weeks before we could have paper made to match we are obliged to use a different quality for these last signatures of the volume. —EDS.]

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